ISSN 0836-0545

1986 AIR QUALITY DATA SUMMARY

REGIONAL MUNICIPALITY OF NIAGARA

APRIL 1988

Ministry of the Environment

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West Central Region

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REGIONAL MUNICIPALITY OF NIAGARA

Ministry of the Environment
Air Quality Assessment
Technical Support Section
West Central Region
April , 1988

ISSN 0836-0545

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ABSTRACT

This report summarizes the results of air monitoring in the Regional Municipality of Niagara in 1986.

General ambient air quality as characterized by Niagara Falls and St. Catharines Air Pollution Index stations was excellent. Monitoring near industrial sources showed local air quality problems exist. These include:

- General Abrasives in Niagara Falls where particulate fallout and occasional odours occurred. The company modified their control systems in 1987 and started an improved maintenance and contingency plan to minimize process upsets. The plan was to be submitted to the Ministry by the end of 1987.

- Cyanamid in Niagara Falls where particulate fallout occurred. The company installed baghouses to collect materials handling emissions in November, 1987. The plant will also be resurveyed to determine other dust emission sources.

- Norton Company in Chippawa where particulate fallout and occasional odours occurred. Odours from the remaining fugitive sources will be controlled in 1988 by directing the emissions into the tall stack. Dust emissions will be reduced by replacing a baghouse, also in 1988.

- Ontario Paper Limited in Thorold where particulate fallout and occasional sulphur dioxide emissions occurred. A Control Order was served in 1986 which included further sulphur dioxide, particulates and odour control over three years for the chemical recoveries portion of the plant - the main sources of emission. Since that time, the company has shut down that portion of the plant. As a result, emissions now meet requirements and the Ministry has withdrawn the Order.

- Exolon Limited in Thorold where particulate fallout and odours occurred. The company instituted a voluntary control program in 1986 to modernize furnace operations. However, interim items of the program have not been complied with and have resulted in a rescinding of the program. The plant will be surveyed with the intent of serving a Control Order in early 1988.

- Aimco Foundry in St. Catharines where particulate fallout occurred. Improved controls in 1986, significantly improved dust measurements and further controls were completed in 1987. Another plant emission survey is scheduled for 1988.

- Burnstein Castings in St. Catharines where particulate fallout and odours occurred. A Control Order will be served in 1988 to address emission problems.

RÉSUMÉ

Le présent rapport résume les résultats de la surveillance de la qualité de l'air de la municipalité régionale de Niagara en 1986.

La qualité générale de l'air ambiant mesurée aux postes de mesure de l'Indice de pollution atmosphérique de Niagara Falls et de St. Catharines était excellente. Cependant, la surveillance effectuée près des sources industrielles a révélé des problèmes locaux de qualité de l'air :

- À la société General Abrasives, de Niagara Falls, où se produisaient des retombées de particules et des odeurs occasionnelles. La société a modifié son système de dépollution en 1987 et a élaboré un plan amélioré d'entretien et de mesures d'urgence afin de réduire au minimum les perturbations environnementales. Le plan devait être soumis au ministère à la fin de 1987.

- À la société Cyanamid, de Niagara Falls, où se produisaient des retombées de particules. La société a installé en novembre 1987 des dépoussiéreurs à sacs filtrants en vue de capter les poussières reliées à la manutention de matériaux. L'usine fera par ailleurs l'objet d'une autre étude afin de déterminer la source des autres émissions de poussières.

- À la société Norton, de Chippawa, où se produisaient des retombées de particules et des odeurs occasionnelles. Les odeurs provenant des sources restantes d'émissions fugitives seront éliminées en 1988 en faisant passer les émissions dans la grande cheminée de l'usine. Les émissions de poussières seront réduites par le remplacement d'un dépoussiéreur à sacs filtrants, également en 1988.

- À la société Ontario Paper Limited, de Thorold, où se produisaient des retombées de particules et des émissions occasionnelles de dioxyde de soufre. Un arrêté d'intervention de 1986 oblige la société à procéder à une réduction supplémentaire des émissions d'anhydride sulfureux, de particules et d'odeurs sur une période de trois ans dans la section de récupération chimique de l'usine, d'où provient la plus grande partie des émissions. Depuis, la société a fermé cette section. En conséquence, le volume d'émissions est maintenant conforme aux normes, et le ministère a retiré son arrêté d'intervention.

- À la société Exolon Limited, de Thorold, où se produisaient des retombées de particules et des émissions d'odeurs. La société a établi en 1986 un programme de dépollution volontaire dans le but de moderniser ses chaudières. Cependant, certains aspects du programme n'ont pas été respectés et ont entraîné son annulation. L'usine fera l'objet d'une étude aux fins de la délivrance d'un arrêté d'intervention au début de 1988.

- À Aimco Foundry, de St. Catharines, où se produisaient des retombées de particules. Après l'amélioration de la dépollution en 1986, les émissions de poussières ont nettement diminué, et d'autres mesures ont été mises en oeuvre en 1987. Une autre étude des émissions de l'usine est prévue pour 1988.

- À la société Burnstein Castings, de St. Catharines, où se produisaient des retombées de particules et des émissions d'odeurs. Un arrêté d'intervention sera délivré en 1988.

INTRODUCTION

This report summarizes the results of air monitoring in the Regional Municipality of Niagara in 1986.

The Ministry of the Environment has conducted routine monitoring in the area since the early 1970's. The Air Management Program in Ontario is based on controlling man-made emissions to meet ambient air quality objectives, which in turn are based on known effects on health, quality of life or sensitive vegetation, whichever is most stringent. To achieve these objectives, sources of pollution are identified, their emissions evaluated and appropriate control measures are instituted. Ambient air monitoring is used to identify pollution sources, evaluate the need for controls and then determine whether controls have been successful.

In addition to monitoring specific industrial sources, monitoring of a more general nature is also carried out in various localities to determine if air quality objectives are being met and to observe trends in air pollution.

MONITORING NETWORK

The Ministry of the Environment operates a network of monitors in the Regional Municipality of Niagara in Niagara Falls, Chippawa, Port Colborne, St. Catharines, Thorold, and Welland. The Air Pollution Index (API) is measured in St. Catharines and Niagara Falls. The API is used as a warning system to alert the public to elevated air pollution levels. It is derived from 24 hour average concentrations of sulphur dioxide and particulate matter measured at single monitoring stations in those cities. The combination of these two pollutants at high concentrations has been shown to be indicative of adverse health effects. Hourly concentrations of both pollutants are telemetered to a central computer facility in Toronto. The computer then calculates the index, a dimensionless number based on the following mathematical equations:

St. Catharines

$$API = 1.15\ (16.84\ COH + 138.4\ SO_2)^{.97}$$

Niagara Falls

$$API = 1.47\ (15.74\ COH + 131.7\ SO_2)^{.92}$$

where:
COH is the 24-hour average soiling index concentration expressed in coefficient of haze units.

SO_2 is the 24-hour average concentration of sulphur dioxide expressed in parts per million.

Values below 32 are considered acceptable. At 32, known as the advisory level and with a forecast of continued unfavorable conditions, significant industrial sources may be

asked to voluntarily curtail operations. At an API of 50, major emitters would be ordered by law to curtail some operations. At 75, further cutbacks would be required and at 100, all sources not essential to the public health and safety could be ordered to cease operations.

Meteorological data (wind and temperature) are measured near Allanburg. Figure 1 illustrates the wind frequency distribution for the area and shows that winds from the west and southwest quadrants predominate almost 40% of the time. Consequently, wherever possible, stations are normally located "downwind" of suspected pollution sources with respect to these wind directions.

Wind data were utilized in a computer program known as a "pollution rose" - essentially a cross-tabulation of average hourly pollutant concentrations with wind direction. The data from this program are illustrated on various maps in this report and are a useful tool in determining the impact of any given source on a monitoring station. The length of each line of the "rose" is proportional to the average yearly concentration when the wind was blowing from that direction.

POLLUTANTS MONITORED

Two basic types of air pollutants are measured-gases and particulates (dust).

a) Gases measured with continuous analyzers include:

- Sulphur Dioxide (SO_2) - mostly monitored near industrial sources but SO_2 is also a product of domestic space heating. Air quality criteria and their underlying limiting factors are:

  1-hour average - .25 ppm (vegetation effects)
  24-hour average - .10 ppm (health effects in conjunction with particulates)
  1-year average - .02 ppm (vegetation effects)

- Total Reduced Sulphur (TRS) - measured exclusively near industrial sources. The measurement includes hydrogen sulphide (H_2S), the "rotten egg" gas but also other sulphur compounds. There are no general criteria for TRS but a one-hour criterion of 20 ppb exists for H_2S (given below). However, H_2S can actually be smelled at 10 ppb or less.

  1-hour average - 20 ppb (odour)

- Carbon-Monoxide-(CO) - measured for general ambient levels in St. Catharines. The major source of CO is the automobile. Criteria for CO are:

  1-hour average - 30 ppm (health effects)
  8-hour average - 13 ppm (health effects)

- Ozone (O_3) - measured in St. Catharines to check

general ambient levels. Oxidants are products of photochemical reactions involving oxides of nitrogen, hydrocarbons and sunlight and ozone accounts for most of the oxidants produced. The sources of the precursor pollutants are mainly industrial and automotive. Concentrations follow very definite annual and daily trends with highest levels occurring during the summer, and daily maxima usually occurring in mid-afternoon. Both patterns are directly related to temperature and the amount and intensity of sunlight. Ozone and its precursors can be transported over great distances and can be augmented by local sources. Most of the high levels measured in Southern Ontario each summer arrive from the United States. An objective for ozone is:

1-hour average - 80 ppb (vegetation effects)

- Oxides of Nitrogen - general ambient levels were measured in St. Catharines. They are a product of high temperature combustion sources including the automobile. The most abundant oxides are nitric oxide (NO) and nitrogen dioxide (NO_2). Criteria exist only for NO_2:

  1-hour average - .20 ppm (odour)
  24-hour average - .10 ppm (health effects)

b) Particulates (dust) are measured by three methods, each relating to a different size range of particles.

- Dustfall - heavy material generally greater than 10 microns in size (one micron is one-millionth of a metre) that settles out of the atmosphere by gravity. A plastic container is exposed for one month and the collected dust is weighed and expressed as a

deposition rate of grams/square metre/30 days. The measurement is imprecise and observations are restricted to relatively local areas. Criteria are:

1-month average	- 7.0 g/m^2/30 days	(nuisance effects)
1-year average	- 4.5 g/m^2/30 days	(nuisance) effects)

- Total Suspended Particulates (TSP) - measured with high volume (hi-vol) samplers near industrial sources and for general ambient observations. The particles range from submicron to about 50 microns in size. The hi-vol sampler draws air through a glass fibre filter for a 24 hour period. The exposed filter is weighed and the weight of solids collected is converted to an equivalent concentration in air. Units used are micrograms per cubic metre. The samplers run once every six days. Criteria based on health effects in conjunction with sulphur dioxide are:

24-hour average	- 120 ug/m^3	(health effects)
1-year geometric mean	- 60 ug/m^3	(health effects)

- Soiling Index (Coefficient of Haze) - measured by tape samplers which measure fine particles less than 10 microns. Industrial sources as well as general ambient air are monitored. Coefficient of haze tape samplers determine hourly soiling values. Air is drawn through a filter paper tape for one hour. A beam of light is shone through the paper before and after the airborne particles are collected. The difference in light transmission is translated into a coefficient of haze (COH) unit. The paper tape then

advances and a new hourly sample is collected. The criteria shown below are based largely on correlations with total suspended particulate (TSP).

24-hour average - 1.0 COH's/1000 linear feet of air
1 year average - .5 " " " " " " "

DATA ANALYSIS

Niagara Falls

The Air Pollution Index (API) Station (27056) on Allendale Avenue, near the Falls tourist (Figure 2) area reached a maximum API of 17 on January 17, still well below the advisory level. Elevated pollutant levels were widespread on this day as the Hamilton and St. Catharines APIs were also elevated. Normally however, the API was very low, averaging only 4 for the year.

Sulphur dioxide and soiling index concentrations at the Allendale Avenue station 27056 given in Tables 1 and 3 were generally low and met all objectives. Figures 9 and 12 show the yearly trends for these two parameters at the API station dating back to 1980. Little change in levels is evident.

The pollution rose given in Figure 20 for sulphur dioxide shows the highest average for east winds indicating the influence of the Niagara Falls, New York industrial area. For soiling index in Figure 21, highest levels were from the southeast quadrant. This may indicate a small influence of traffic in the Falls tourist area.

Suspended particulates (TSP) at API station 27056 were generally low and met the yearly objective (Table 7). The daily objective was not exceeded. The trend of TSP dating back to 1980 is given in Figure 16 and shows a gradual decline in levels since that time to well below the yearly objective. It is possible that this decline is partly related to the move from 27049 to 27056 in 1983.

Station 27055 at Stanley St., Niagara Falls, 500 metres northeast of General Abrasive Ltd., completed its third full year of monitoring in 1986. The station contains SO_2 and TRS continuous analysers, a soiling index tape sampler and a hi-vol.

The data for SO_2 and TRS is given in Tables 1 and 2 and show mostly low levels. All objectives for sulphur dioxide were met (Table 1). In the case of TRS, there were 26 hours in which the objective for hydrogen sulphide was exceeded (Table 2), compared to only 10 in 1985. The pollution roses in Figures 22 and 23 indicate that General Abrasives is the primary source of both pollutants as both roses show peaks under south-southwest winds. For sulphur dioxide, some importation from the U.S. from the east-southeast is also evident.

The major source of odours at the plant are the silicon carbide furnaces. The company has conducted stack testing and modified their control system which consists of a baghouse and incinerator for collection of dust, SO_2 and TRS. Although improvements in SO_2 have been noted in 1987, TRS has not improved, despite a continuous incinerator operation. The company has started an improved maintenance and contingency plan to minimize process upsets and resulting emission excursions. The plan was submitted to the Ministry at the end of 1987.

The hi-vol at station 27055 (Stanley St.) measuring suspended particulates showed a worse situation as the yearly mean was high at 81 ug/m^3 (Table 7) relatively similar to 1985 levels but lower than in 1984. Additionally, 16% of the samples exceeded the daily objective of 120 ug/m^3, compared to 44% in 1984. The improvement may be partly attributable to the completion of nearby construction and sandblasting at the Niagara Falls sewage treatment plant which had been ongoing throughout 1984. Some minor problems with dust collection equipment at General Abrasives that were corrected during 1985 could also have influenced the TSP data.

The major sources of dust emissions are both the silicon carbide and aluminum oxide furnaces. However, emissions from

the product handling operation for these furnaces will be redirected into the existing control systems.

The soiling index tape sampler at 27055 (Stanley St.) which measures much finer particles than the hi-vol showed much lower concentrations (Table 3) within criteria - the daily objective was not exceeded. The pollution rose in Figure 24 indicates a small contribution of fine particles from General Abrasive under southwest winds. Fallout from this plant would appear to consist primarily of larger particles affecting a very localized area. The greatest impact on station 27055 soiling index as shown in Figure 24, is from the southeast, ie., possibly from Cyanamid (to be discussed below).

Suspended particulates were also measured at Station 27050 on Victoria Avenue 500 metres west of Cyanamid (Figure 3). The station was moved to this location from Station 27053-First and Bridge. The new location was more downwind of Cyanamid with respect to predominant winds and this likely accounts for the increase in the yearly mean to well above the objective (Table 7). As mentioned, the soiling index sampler at station 27055 northwest of the plant also seemed to show a small impact from Cyanamid (Figure 24).

The major sources of dust from Cyanamid are the calcium carbide furnace and its product handling system. The latter is now controlled with new baghouses as of November, 1987. The company will also be further surveyed in 1988 to determine other dust emission sources.

Despite the station's proximity to Cyanamid, correlations of suspended particulate readings with wind direction did not indicate Cyanamid to be the only source of dust. No wind direction correlated strongly with the TSP data. It is possible that various fugitive dust sources nearby confounded

the results.

Chippawa

Station 27051 at Norton and Portage, 200 metres northeast of the Norton Company (Figure 4) indicated that air quality problems near the plant still exist despite the installation of a tall stack in 1982. The station contains SO_2 and TRS analyzers. Hi-vol and dustfall measurements were also made in the area.

SO_2 and TRS data are summarized in Tables 1 and 2. Although all SO_2 objectives were met (Table 1), the one-hour objective for hydrogen sulphide was exceeded 43 times during the year (Table 2) - an improvement from 1984 and 1985. The trend graphs in Figures 10 and 11 do show that the sulphur dioxide hourly objective has not been exceeded since 1982, and that TRS exceedences of 20 ppb have decreased dramatically since 1982. The installation of the tall stack previously mentioned is largely responsible for this improvement.

Pollution roses in Figures 25 and 26 clearly indicate the contribution of the Norton plant as both SO_2 and TRS roses show peaks under southwest winds. The remaining SO_2 and TRS source at Norton is the product handling system. This fugitive (non-stack) source will be controlled in 1988 by redirecting the emissions into the tall stack.

Suspended particulate concentrations were also measured at Station 27051. The yearly mean was only 62 ug/m^3, marginally exceeding the yearly objective, and 3 samples out of 59 exceeded the daily objective (Table 7). Each exceedence occurred on southwest wind days. The trend graph in Figure 17 shows the huge improvements in TSP levels dating back to 1974 due to various emission control improvements made at

this plant. The remaining particulate sources at Norton are the product handling system and one of the furnace baghouses which needs replacement, to be carried out in early 1988.

Dustfall near the Norton plant at 27005, Portage and Legion Figure 3) exceeded the monthly objective in 5 out of 11 samples (Table 9). The background jar (27006) at Bridgewater and Oliver recorded much lower and acceptable levels although one sample read high. Similar to TSP, dustfall levels at 27005 have improved greatly since the 1970s (Figure 19). The source of the dust at Norton is the previously mentioned furnace operation which will have its emission control system replaced in 1988.

Port Colborne

Hi-vol 27047 measuring suspended particulates 350 metres north-northwest of INCO (Figure 5) recorded generally low and acceptable concentrations, similar to 1985 (Table 7).

Two samples exceeded the daily objective. The refinery's effect on TSP levels appears to be minor as no wind direction correlated well with the data.

INCO shut down during June 2 - August 10 and interestingly the geometric mean during this period was much higher than the overall yearly mean (68 ug/m^3 vs 52 ug/m^3). One of the two TSP exceedences occurred during the shut down. Re-entrainment of fugitive dust, including road dust is a possible source in the area.

The samples were analyzed for nickel, and one excessive concentration above the objective (2 ug/m^3) was observed with two other elevated nickel readings well above normal levels (Table 8). The nickel levels correlated strongly with winds from the refinery, indicating that INCO did have an effect on

the measurements.

It would appear that INCO's effect on air quality was fairly small and localized. However, past Phytotoxicology Section surveys have demonstrated nickel contamination of vegetation in the area well above guidelines. No formal abatement program was scheduled for 1985-86 although the company has purchased neighbouring properties in order to provide a buffer zone. Process modifications have been implemented in 1987 and reduced production should further improve air quality.

The soil in the vicinity of the plant is nickel contaminated from past practices rather than current operations, and some re-entrainment accounts for nickel deposition on vegetation.

St. Catharines

The API measured downtown at station 27037, North and Geneva (Figure 6), reached a maximum of 18 on January 17, a date common to Niagara Falls' maximum. Elevated API's in St. Catharines were generally due to soiling index rather than sulphur dioxide and were probably due to local traffic emissions during poor dispersion conditions. Normally the index was very low, averaging only 5 for the year.

Concentrations of sulphur dioxide, soiling index, carbon monoxide and nitrogen dioxide remained mostly unchanged and met all objectives at the API station (Tables 1, 3, 5 and 6). Trends of these pollutants are illustrated in Figures 9, 12, 14 and 15 and show generally stable levels over the years, with the exception of carbon monoxide which has gradually declined since 1977 (Figure 14). This is likely due to improvements in vehicle emission control systems.

Ozone concentrations were higher on average than in 1985, but

showed only 11 hours above the objective as shown in Table 4. The higher average was mostly due to the fact that the station was terminated in September, thus missing the fall readings which are normally low. The trend in yearly exceedences of this objective is illustrated in Figure 13. The variations in this graph are mainly weather related, varying with the temperatures and quantities of sunshine each summer. The higher levels usually occur concurrently with other areas in Southern Ontario, and normally occur during south or southwesterly winds, downwind of sources in the United States.

Pollution roses for SO_2, soiling index, CO and NO_2 (Figures 27-30) all show highest averages during southeast winds probably pointing toward heavily travelled Niagara Street only 75 metres away.

The rose for ozone (Figure 31) shows its highest levels under southwest winds. This peak is not as prominent as might be expected since even during the summer, southerly winds do not automatically yield high ozone. Specific meteorological conditions are necessary. As mentioned, most of the elevated ozone levels measured are probably a result of long range transport from the United States.

The hi-vol at the St. Catharines API station recorded acceptable suspended particulate concentrations in 1986 (Table 7), with only four exceedences of the daily objective. Annual trends at this station given in Figure 9 have been relatively stable over the years, fluctuating marginally above and below the annual objective.

In September, the API station was shut down. The warehouse in which the station was located was sold and slated for demolition. The Ministry later found a new site 1 kilometer to the southeast, just outside the downtown area. This new

location is more remote from traffic effects and thus will likely be more representative of the City. The new station began re-issuing the API in August 1987.

Dustfall near the Aimco Foundry at the Plymouth Ave., station 27040 (Table 9) remained very high as shown in Figure 18, and continued to show elevated concentrations above objectives during 9 months. Some extremely high readings occurred up to July, but from August to the end of the year, levels reduced considerably. The improvement was directly related to the expansion of the furnace and product handling control system as of August 1986. Further controls under the voluntary abatement program were completed in 1987 and another plant emission survey is scheduled in early 1988. Fugitive emissions will be addressed by improved maintenance in future activities.

Dustfall near the General Motors Foundry at Station 27041, Glendale and QEW, (Figure 6, Figure 18 and Table 9) was also high with 7 months exceeding the monthly objective. However, a nearby quarry and related trucking operations are potential contributors to the readings, and microscopic analyses of the samples did show that some samples were composed partly of non-foundry materials, namely carbonates. To ascertain the extent of the quarry's effect on 27041, a second jar has been located directly on G.M. property, away from the quarry road. Preliminary 1987 data at this new location show variable effects with some readings lower than the 27041 readings and some higher, indicating the quarry's and foundry's alternating effect.

The major sources of foundry emissions are their cupolas and G.M will replace a "side take-off" control system. Other furnace modifications are planned as well and the work will likely take place over a three year period.

Dustfall near Burnstein Castings at Station 27054, Catherine and Russel (Figure 6), showed four excessive loadings, of which the December reading was extremely high (Table 9). A survey of the company has been carried out by Abatement staff and a number of problems have been identified. A Control Order will be served later in early 1988 to address odour and particulate emission problems.

Thorold

Sulphur dioxide measured at Station 27042, Niagara Falls Rd. and Ontario St., across from Ontario Paper Limited (Figure 7), showed an acceptable yearly average in 1986. A total of 16 hourly readings exceeded the hourly objective, and the daily objective was exceeded once (Table 1). The major source of SO_2 is from the chemical recovery plant. The trend graph in Figure 10 displays the marked reduction in the number of exceedences of the hourly objective since 1983. The improvement was due to the installation of a scrubber on the company's acid plant in 1981. Some very high short duration emissions attributable to digester blows from the recovery plant are still being observed, however, and the pollution rose in Figure 32 still indicates the influence of the paper mill.

Dustfall near the paper mill is given in Table 9. It shows that the yearly average at station 27042 was twice as high as at the background station 27043 at McAdam Park and sulphate contents were almost 3 times as high. Seven samples exceeded the monthly objective at 27042. The trend graph in Figure 18 does show, though, that improvements have taken place during the 1980s. The major source of particulate is the chemical recovery plant, specifically the vanillin plant portion. A Control Order was served in 1986 and included provisions for further sulphur dioxide, particulate and odour control over the next three years. The company has appealed the Order and

has attempted to sell the chemical recoveries portion of the plant - the main source of emission. However, the sale did not occur and the Order will be addressed in the appeal hearing.

Station 27052 lies 100 metres northeast of Exolon Ltd. on Queen Street (Figure 7) and consists of a hi-vol, soiling index tape sampler and SO_2 and TRS analyzers. SO_2 and TRS data are summarized in Tables 1 and 2. Both pollutants continued to show many excessive concentrations, but some progress has been shown. The yearly TRS average has decreased by about 60% since 1984 and the hourly H_2S objective was exceeded 180 times in 1986 compared to 376 times in 1985 and 567 times in 1984. The major source of these emissions are the silicon carbide furnaces. The company is presently on a voluntary program for control of these furnaces by 1989. However, interim items of the program have not been complied with and have resulted in a rescinding of the program. The Ministry will conduct a survey with the intent of serving a Control Order in early 1988.

Sulphur dioxide levels also improved showing only 16 hours over the hourly objective (compared to 69 hours in 1985) and two daily average exceeded that objective (compared to 4 days in 1985). The silicon carbide furnaces are also the major source of SO_2.

Most of the improvement in 1986 for both SO_2 and TRS can likely be attributed to reduced operation of the silicon carbide furnaces.

The pollution roses in Figures 33 and 34 indicate the influence of Exolon as both peaked sharply under west and west-southwest winds.

Suspended particulates at station 27052 (Table 7) showed extremely high levels with a geometric mean of 144 ug/m^3 (up sharply from 106 in 1985), and 34 out of 58 samples exceeded the daily objective. The silicon carbide furnaces and aluminum oxide furnace are the major source of particulate emissions.

The soiling index tape sampler at 27052 recorded low levels of fine particulate with no exceedences of the daily criterion (Table 3). The soiling index pollution rose in Figure 35 shows little impact from the plant. Particulate emissions from Exolon would seem to consist mostly of heavy material not measured by the tape sampler.

Welland

Suspended particulate concentrations near Union Carbide at station 27045, Alberta and Devon, (Table 7) decreased somewhat from levels measured in 1985. The yearly geometric mean was well below the objective and the daily objective was not exceeded. The trend graph in Figure 17 shows a stable trend since 1981.

Occasionally elevated carbon contents (Table 8) continued to occur, and these data correlated weakly with southwest wind frequency, indicating Union Carbide's localized influence on the area. The major source of dust emissions are the carbottom furnaces. Numerous complaints of fallout are presently being investigated by the Ministry's Investigation and Enforcement Branch. The company has submitted a program to control dust emissions from the furnace operation by 1988. Fugitive dust emissions from a landfill on company property are being addressed through seeding and dust suppression programs.

Dustfall in the area also remained stable from 1985 as shown

in Table 9. One station, 27035 at the base of Alberta St. did show a deterioration. Nine samples exceeded the monthly objective here. This station is located near the dump site mentioned above. The other two monitors (27025-Harriet St. and 27026-Chaffey St.) recorded much lower levels with four exceedences of the monthly objective between them. The trend graph in Figure 19 shows the significant improvements which have taken place since 1980, as a result of a number of abatement measures taken by Union Carbide.

DISCUSSION

This report has identified several local air pollution concerns in the Regional Municipality of Niagara. All are currently under investigation with a view to implementing control programs. Some control programs are already underway.

Apart from these localized problems, general air quality as characterized by our API (Air Pollution Index) stations in Niagara Falls and St. Catharines was very good. The advisory index level of 32 has never been exceeded at either of the two stations and both normally showed very low index readings, averaging 4 and 5 during 1986. They rarely exceed 20. The St. Catharines API station has been relocated in 1987.

In 1987, a new air quality data telemetry system was installed throughout the Province. This new system will permit all of the Ministry's stations with continuous analyzers to send data directly to a central computer facility in Toronto, allowing for data retrieval on a real-time basis. Currently, only the two API stations and the meteorological tower near Allanburg are telemetered to Toronto. The remainder of the stations required manual reading of strip charts for the data. (This process will continue until the telemetry system is functioning properly.) The chart reading process causes delays in the availability of data amounting to several months. The new system will allow for immediate access to data, both in the Regional Office in Hamilton and in Toronto, and will also allow for remote control and maintenance of the instruments. All of this will result in a more efficient monitoring program.

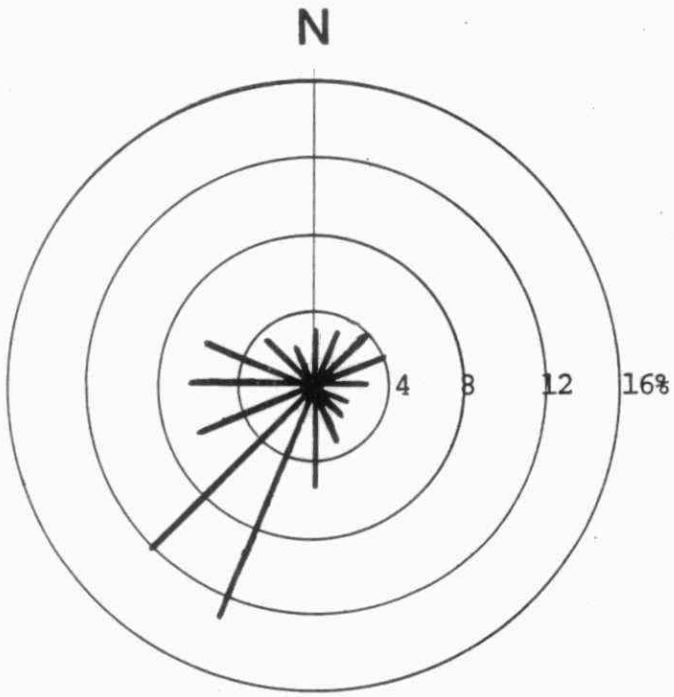
The new telemetry system is being installed to facilitate a new expanded Air Quality Index (AQI). The AQI will be a

function of six different pollutants, which will form up to eight separate subindices. Concentrations of sulphur dioxide, soiling index, carbon monoxide, nitrogen dioxide, total reduced sulphur and ozone will all be individually converted to the current scale of index numbers with the same advisory or alert levels of 32, 50, 75 and 100. Not all stations will measure all of the parameters, but the highest subindex and the pollutant causing it will be reported several times daily to the public. In the Niagara Region, the new AQI's will be reported for the existing St. Catharines and Niagara Falls API stations. The new system has potential to add more communities in the future. The intent of the new index is to better inform the people of Ontario of air quality in their local area.

FIGURE 1

WIND FREQUENCY DISTRIBUTION 1986

27011 - ALLANBURG



Lines indicate direction wind blew <u>from</u>

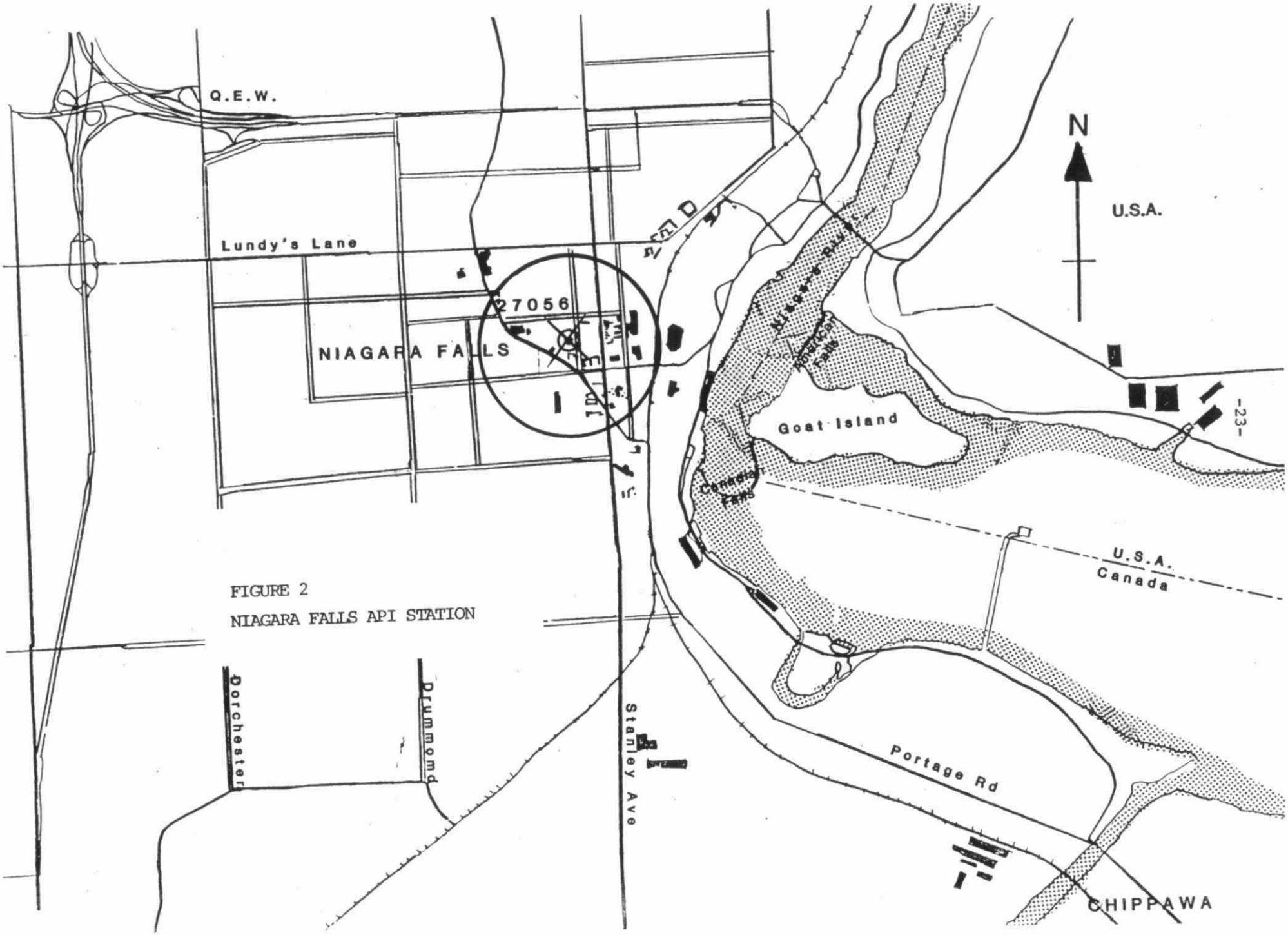


FIGURE 2
NIAGARA FALLS API STATION

FIGURE 3

NIAGARA FALLS INDUSTRY STATIONS

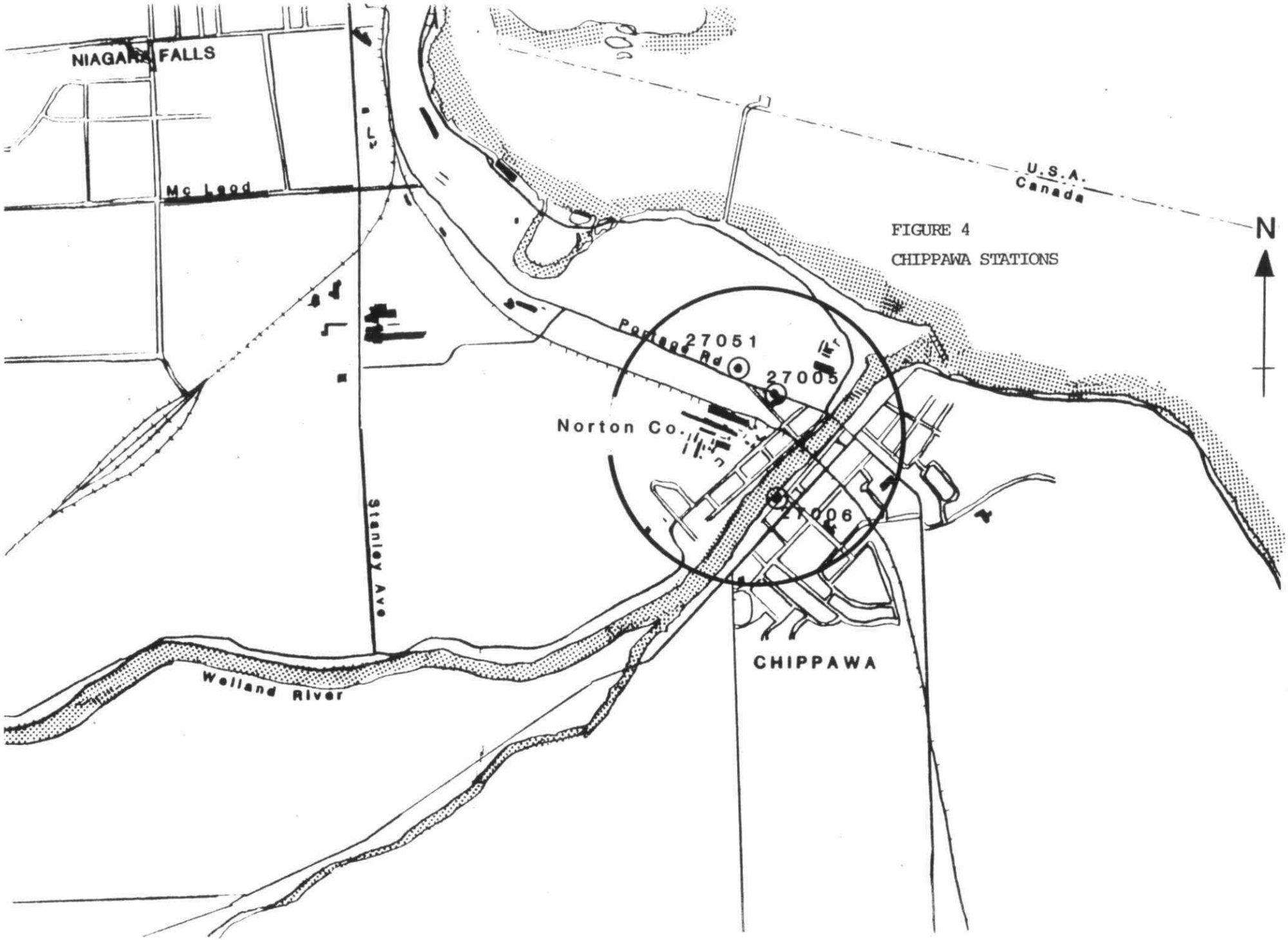
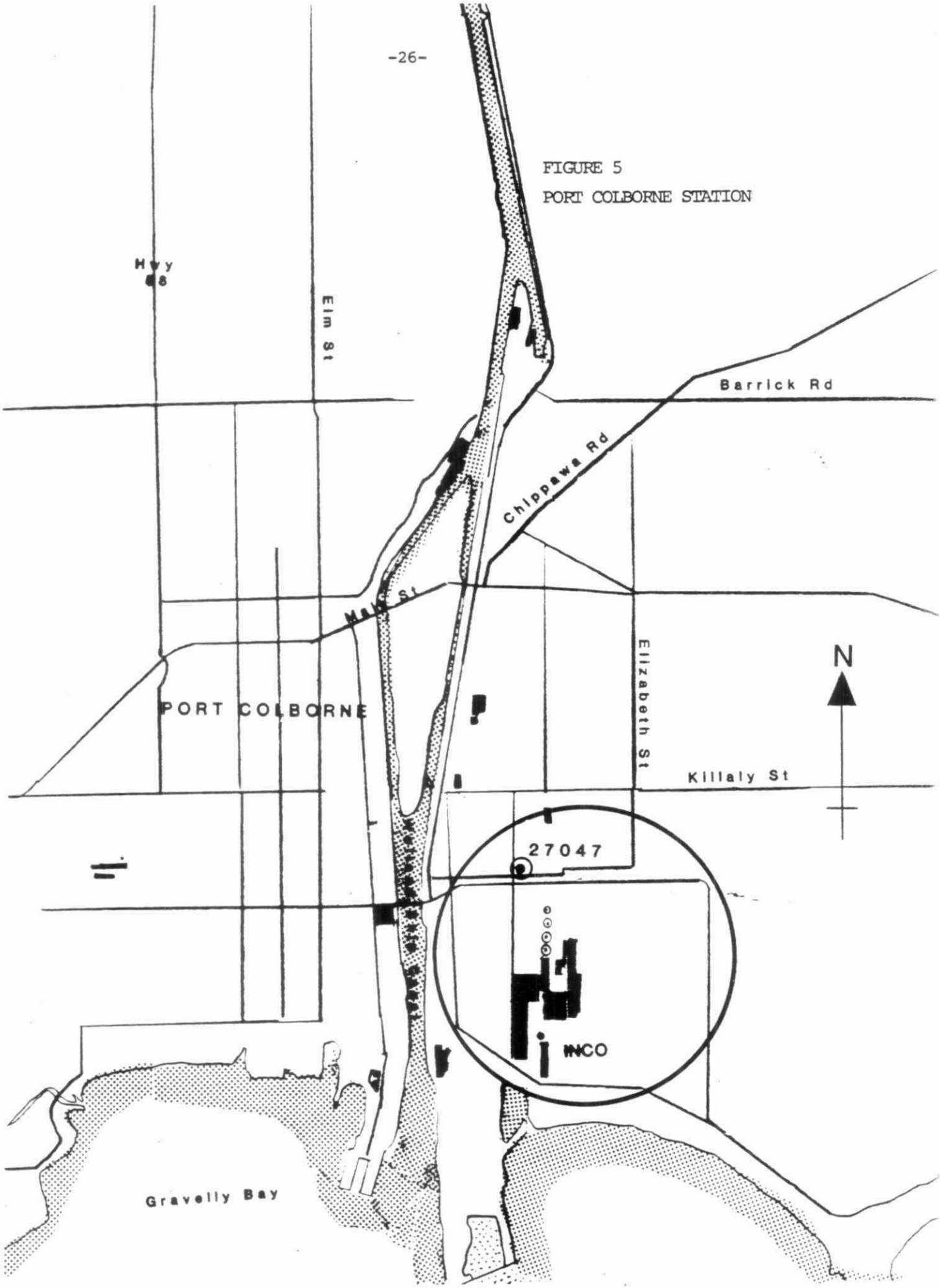


FIGURE 4
CHIPPAWA STATIONS

FIGURE 5
PORT COLBORNE STATION



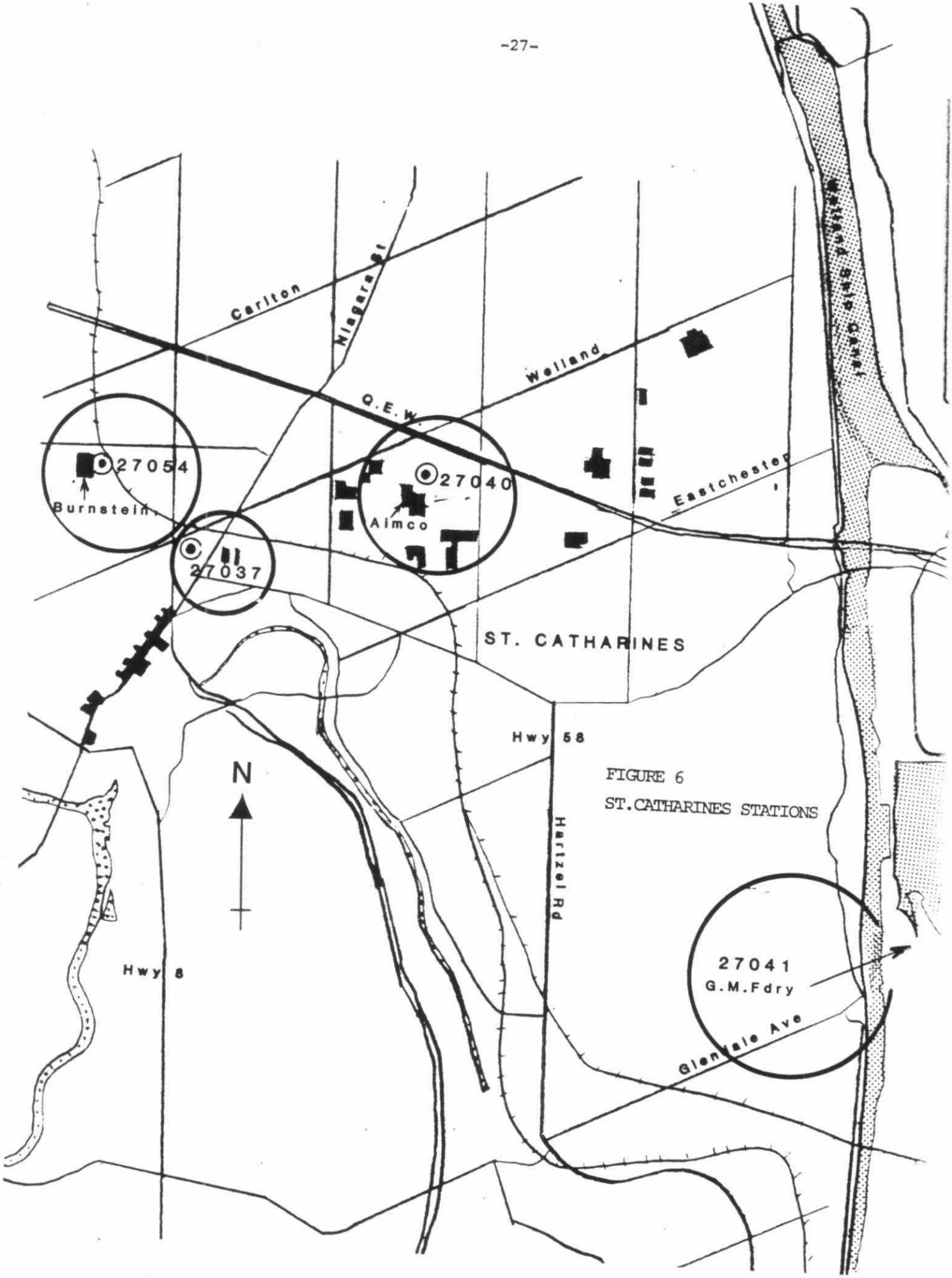


FIGURE 6
ST.CATHARINES STATIONS

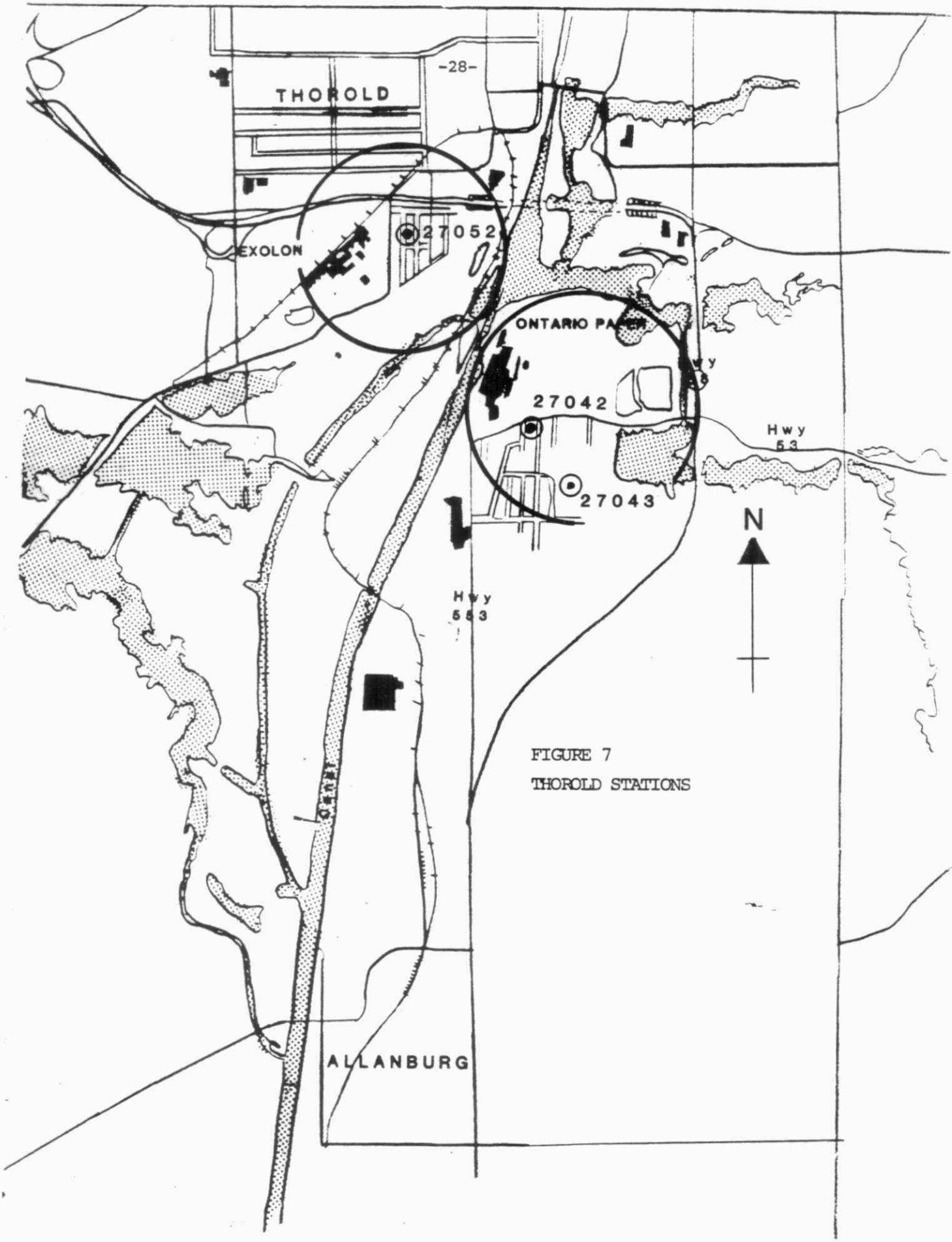


FIGURE 7
THOROLD STATIONS

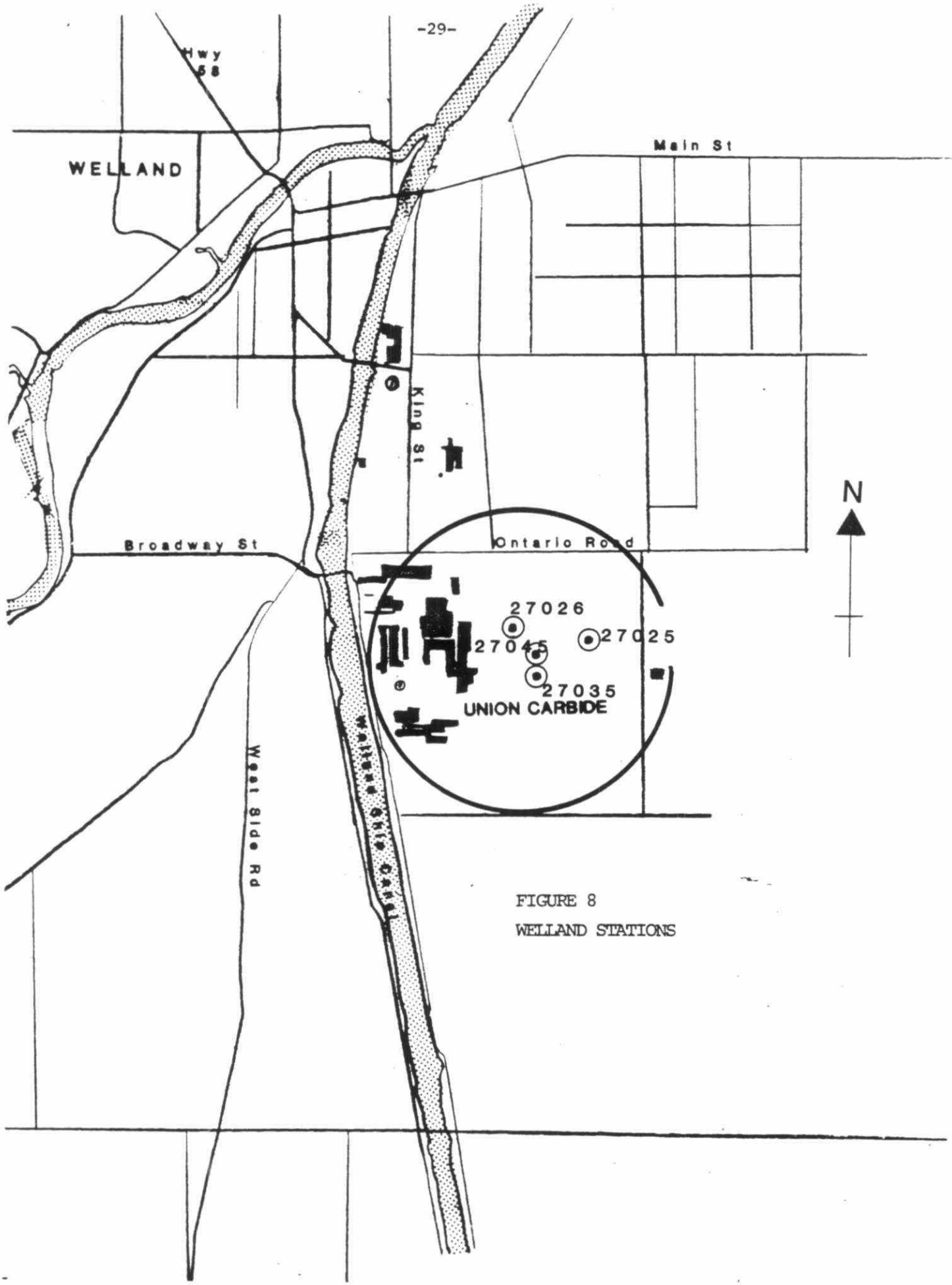


FIGURE 8
WELLAND STATIONS

FIGURE 9

SULPHUR DIOXIDE YEARLY TRENDS

NIAGARA FALLS & ST.CATHARINES

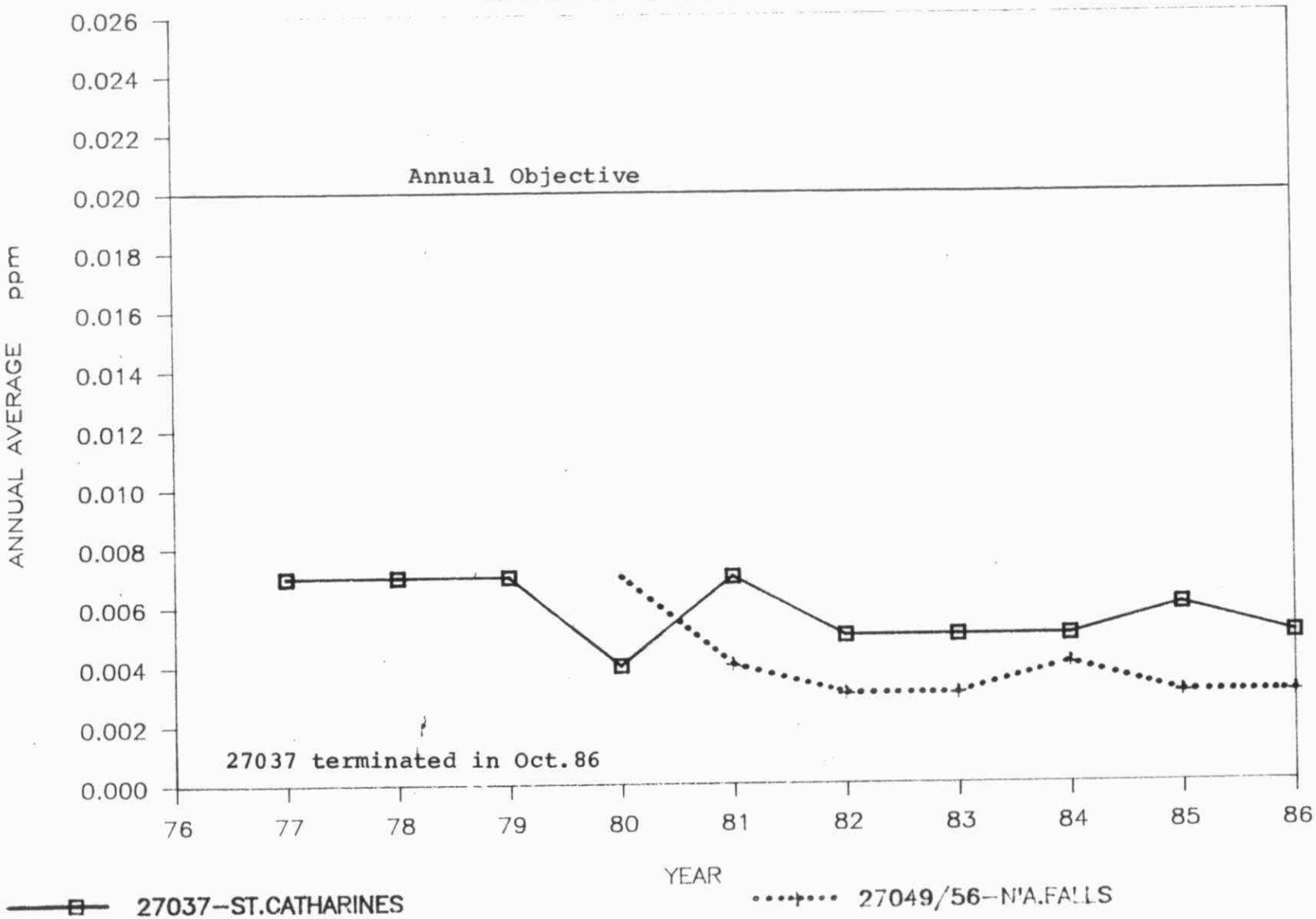


FIGURE 10

SO2 EXCEEDENCE TREND—NIAGARA INDUSTRIES

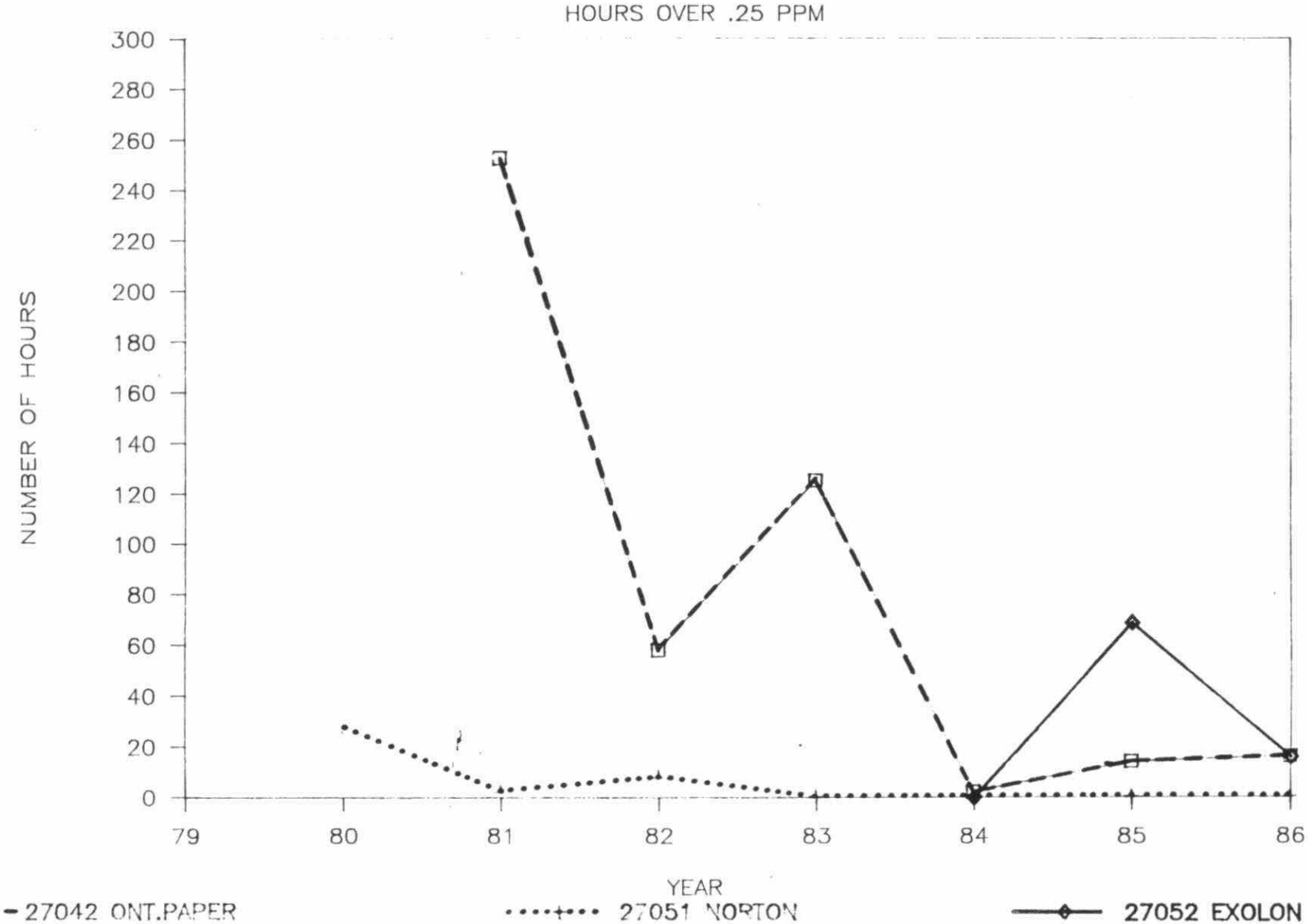


FIGURE 11

TRS EXCEEDENCE TREND—NIAGARA INDUSTRIES

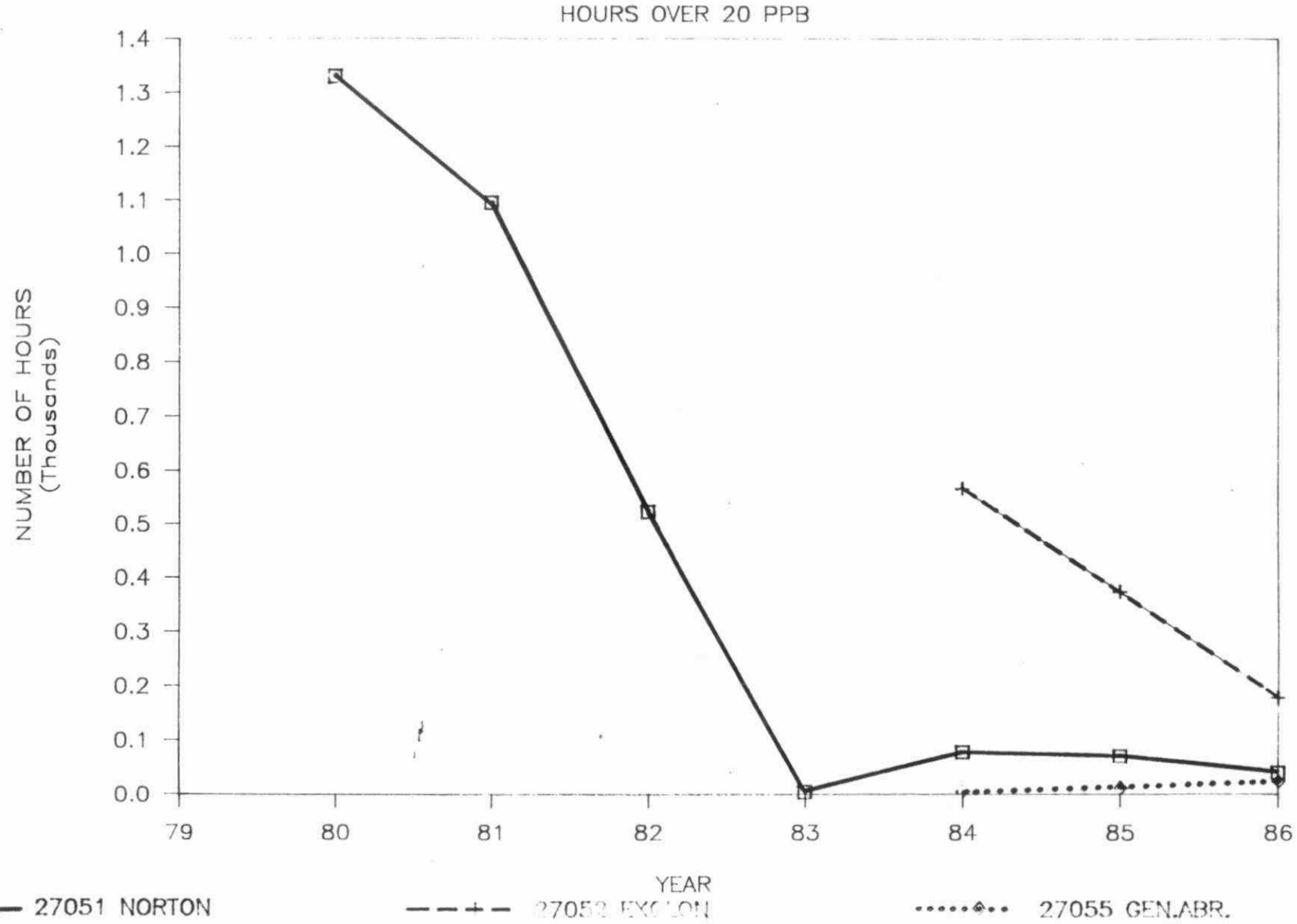


FIGURE 12

SOILING INDEX YEARLY TREND

NIAGARA FALLS & ST.CATHARINES

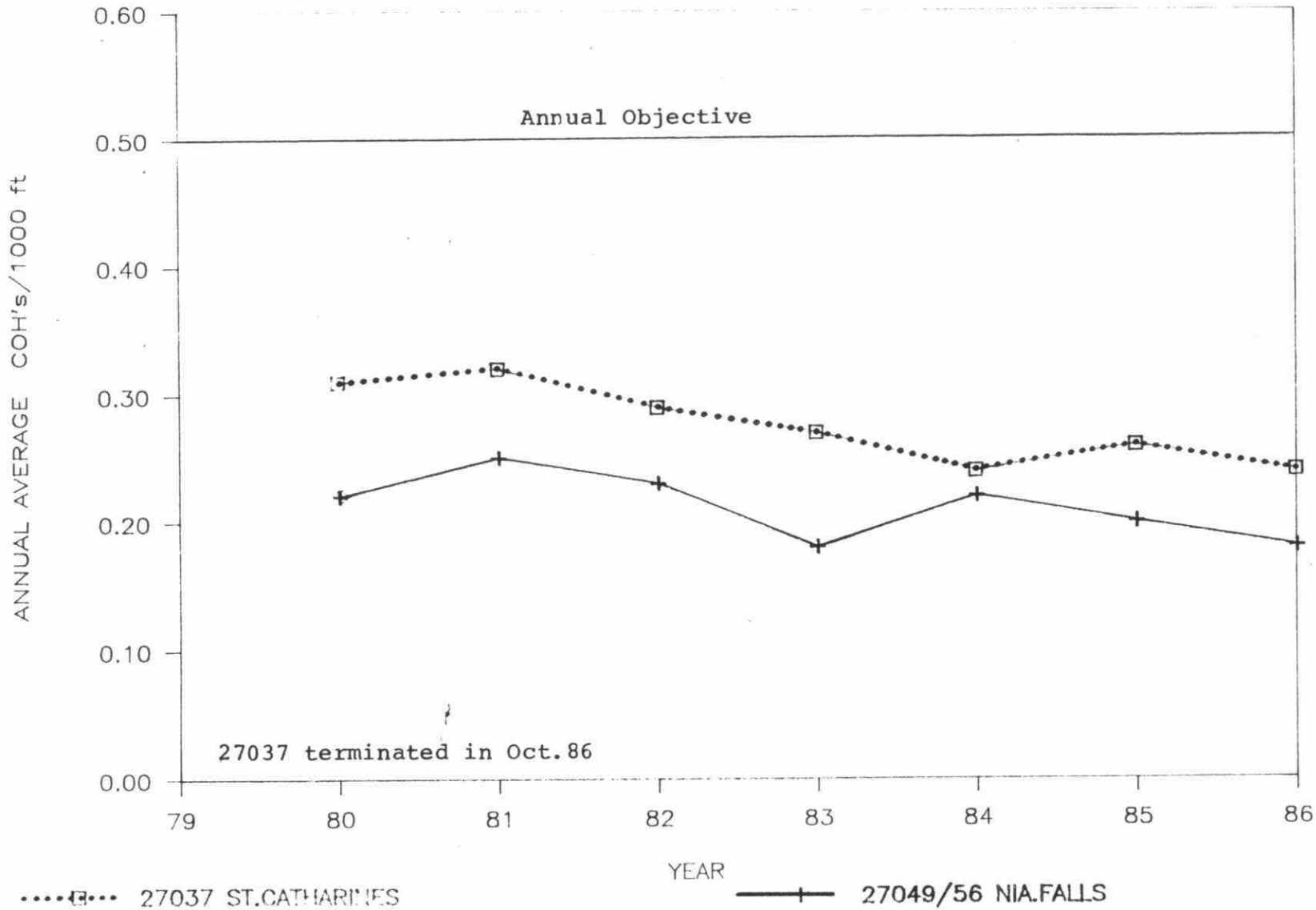


FIGURE 13

OZONE EXCEEDENCE TREND —ST.CATHARINES

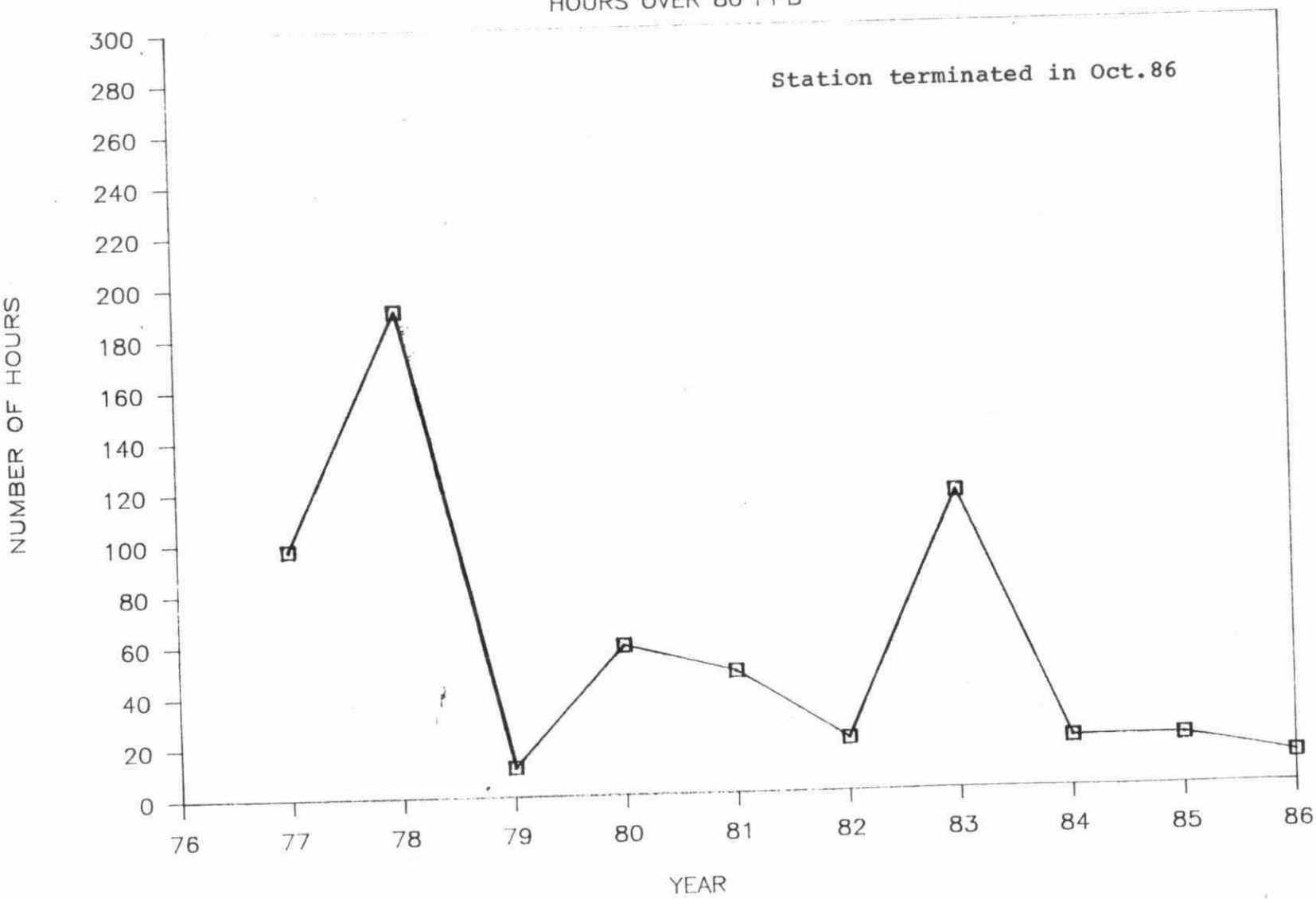


FIGURE 14

CARBON MONOXIDE YEARLY TREND

ST.CATHARINES

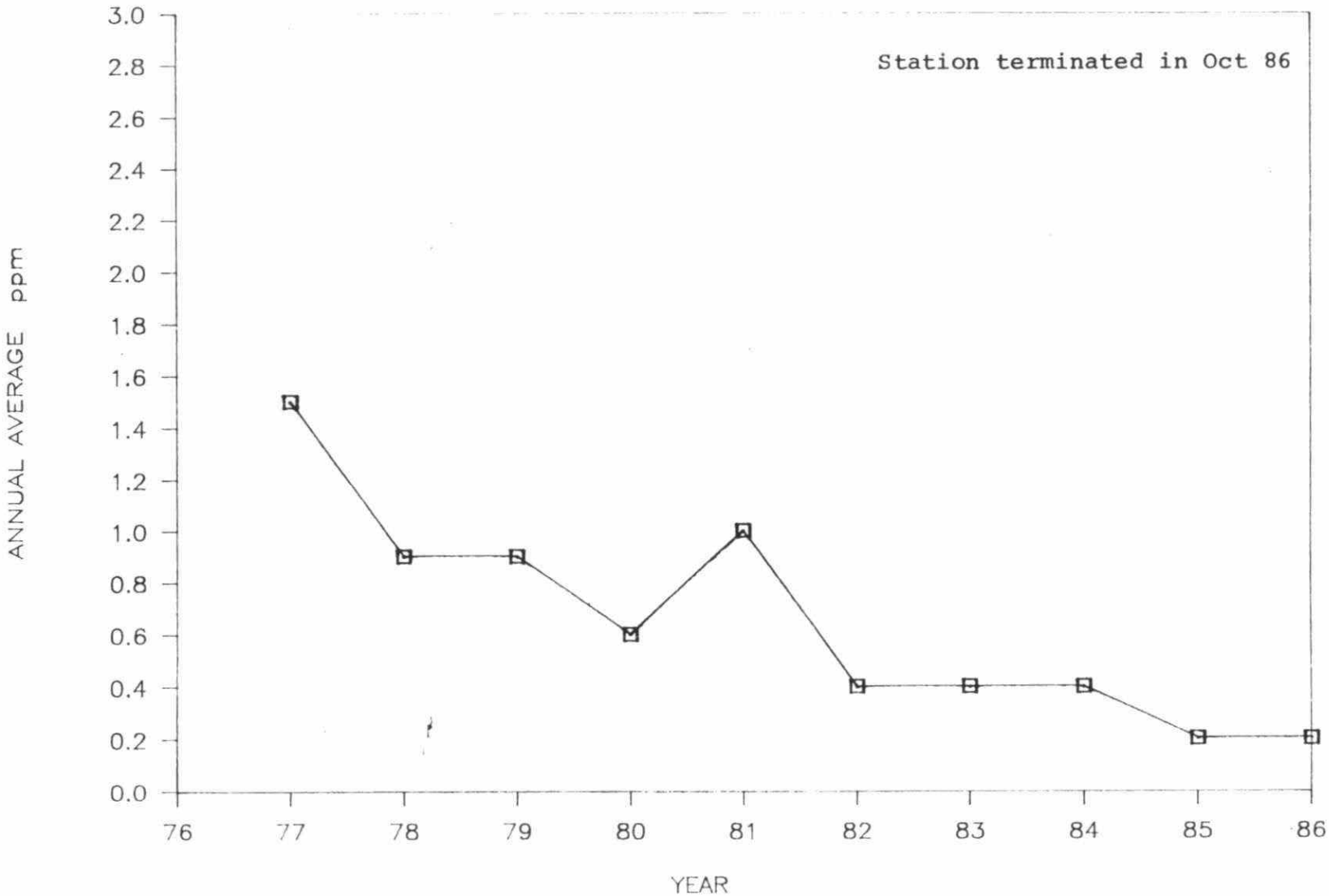


FIGURE 15

NITROGEN DIOXIDE YEARLY TREND

ST.CATHARINES

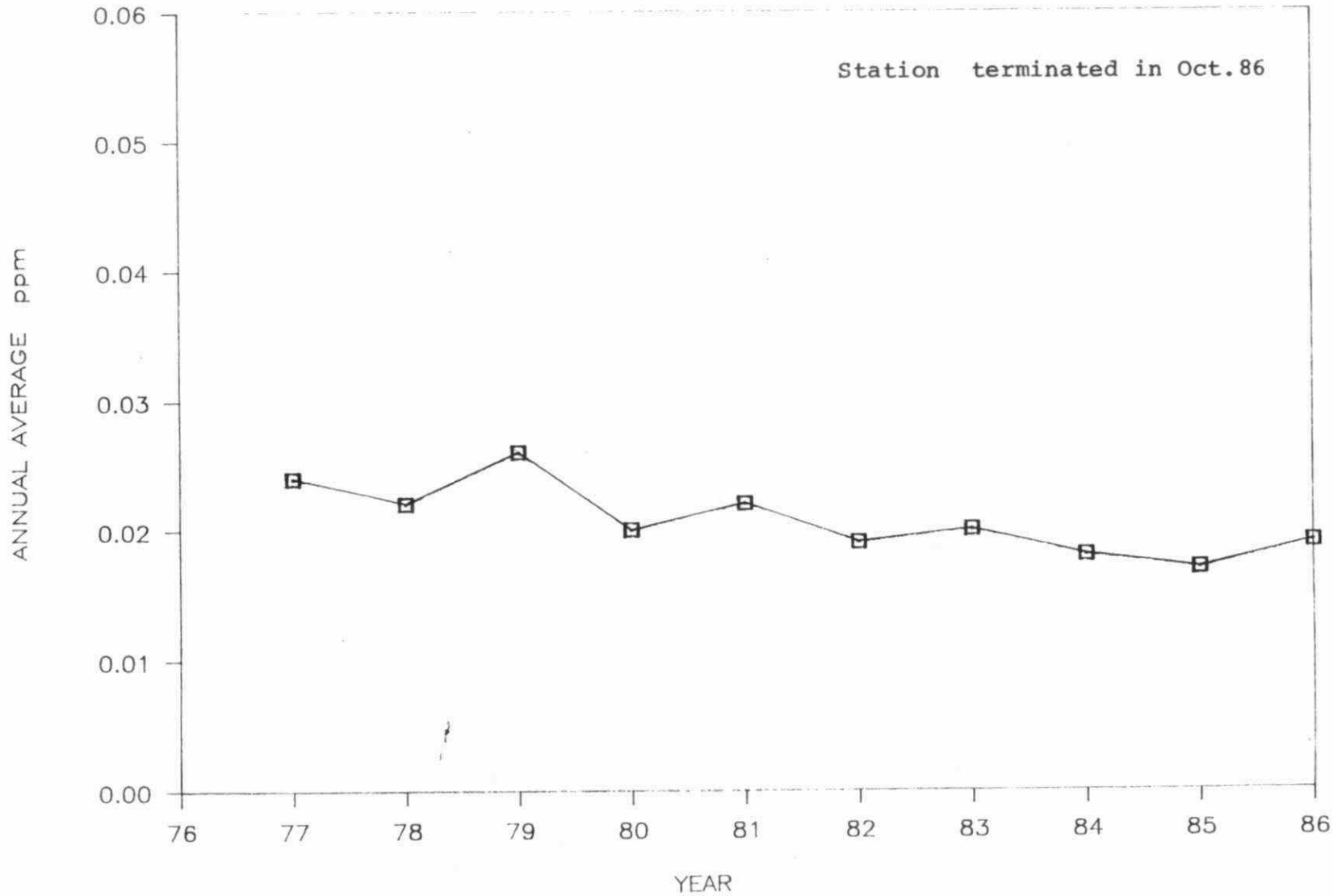


FIGURE 16

SUSPENDED PARTICULATES YEARLY TRENDS

NIAGARA FALLS & ST.CATHARINES

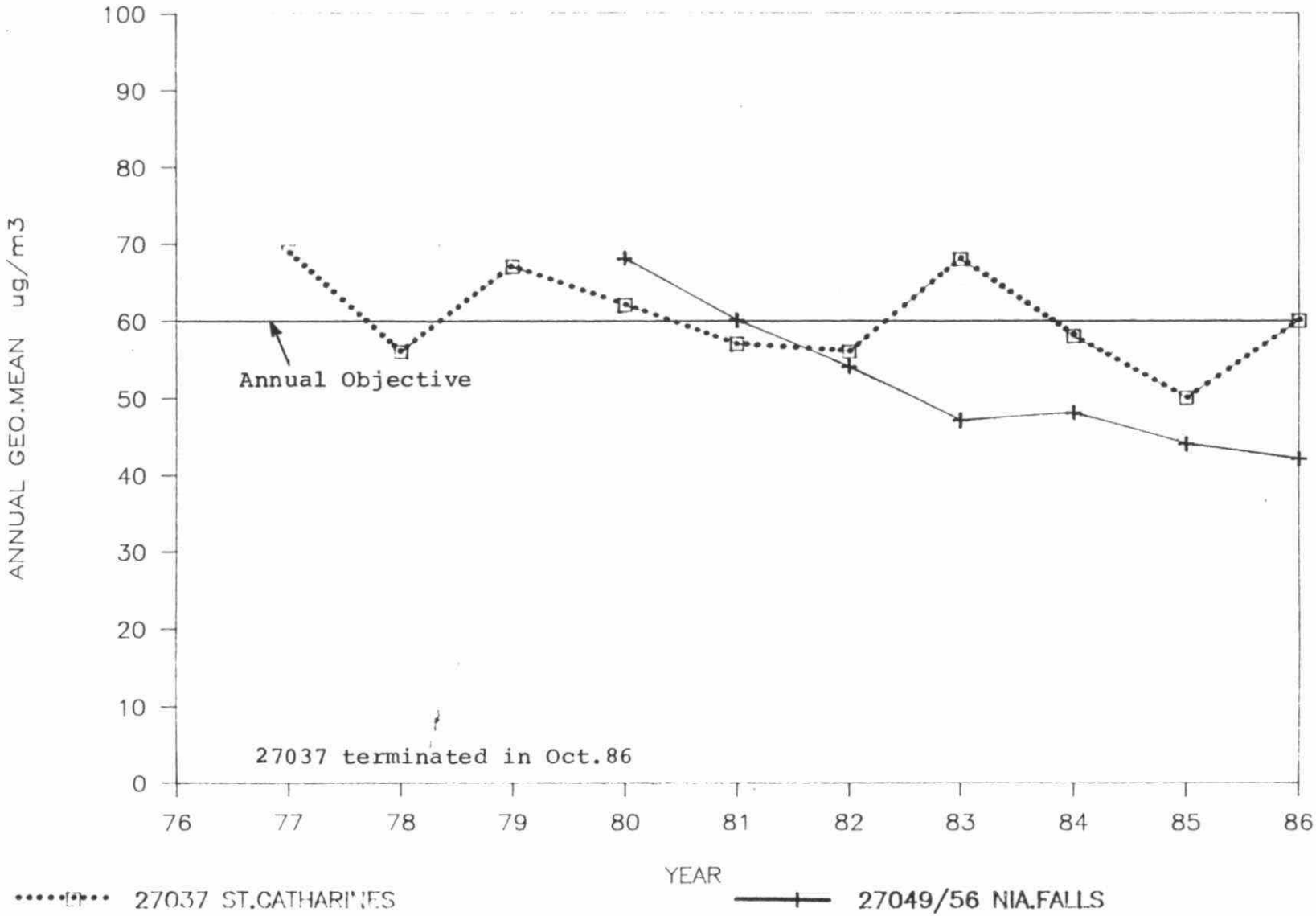


FIGURE 17

SUSPENDED PARTICULATES YEARLY TRENDS

NIAGARA INDUSTRY STATIONS

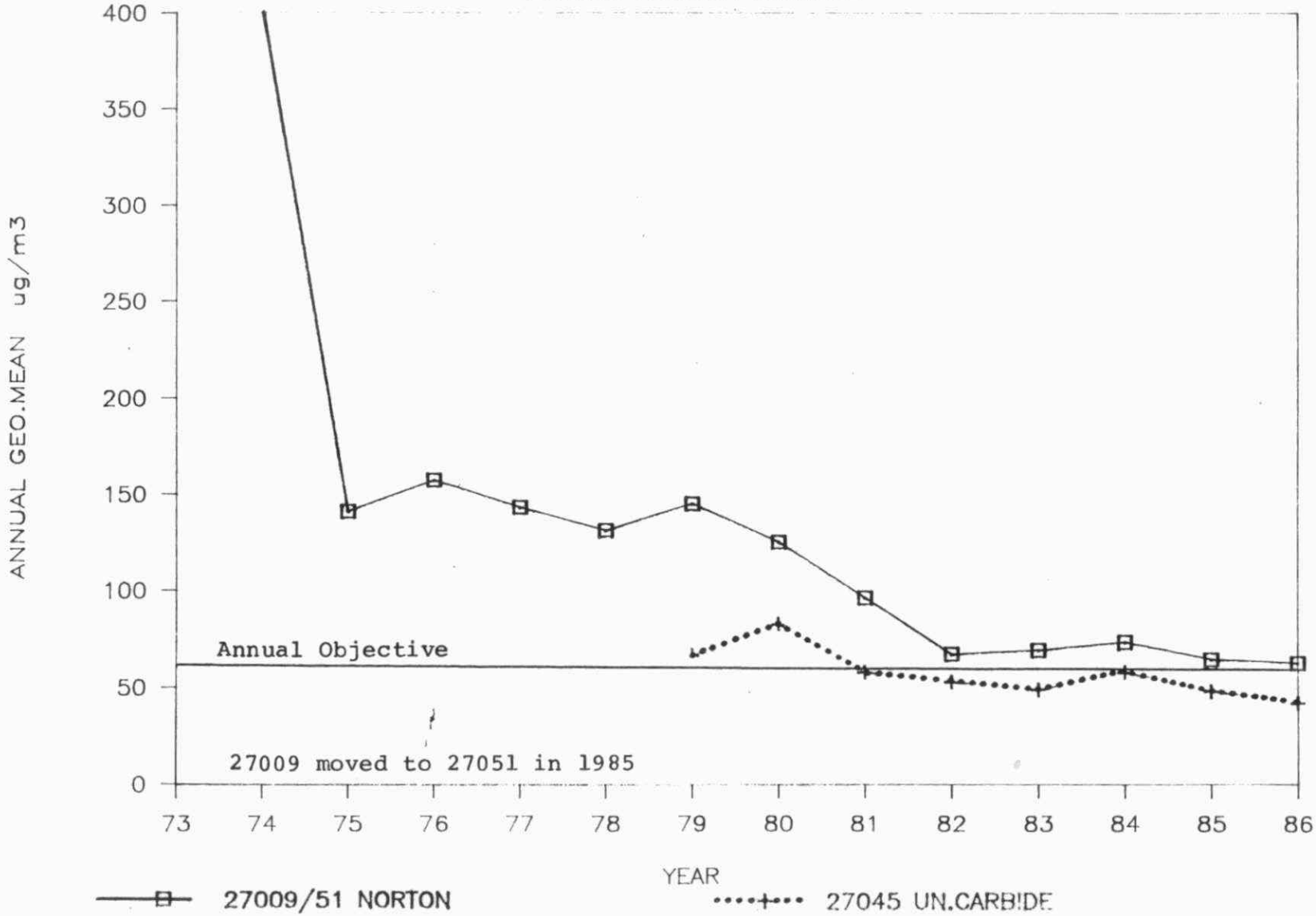


FIGURE 18

DUSTFALL YEARLY TREND

THOROLD & ST.CATHARINES INDUSTRIES

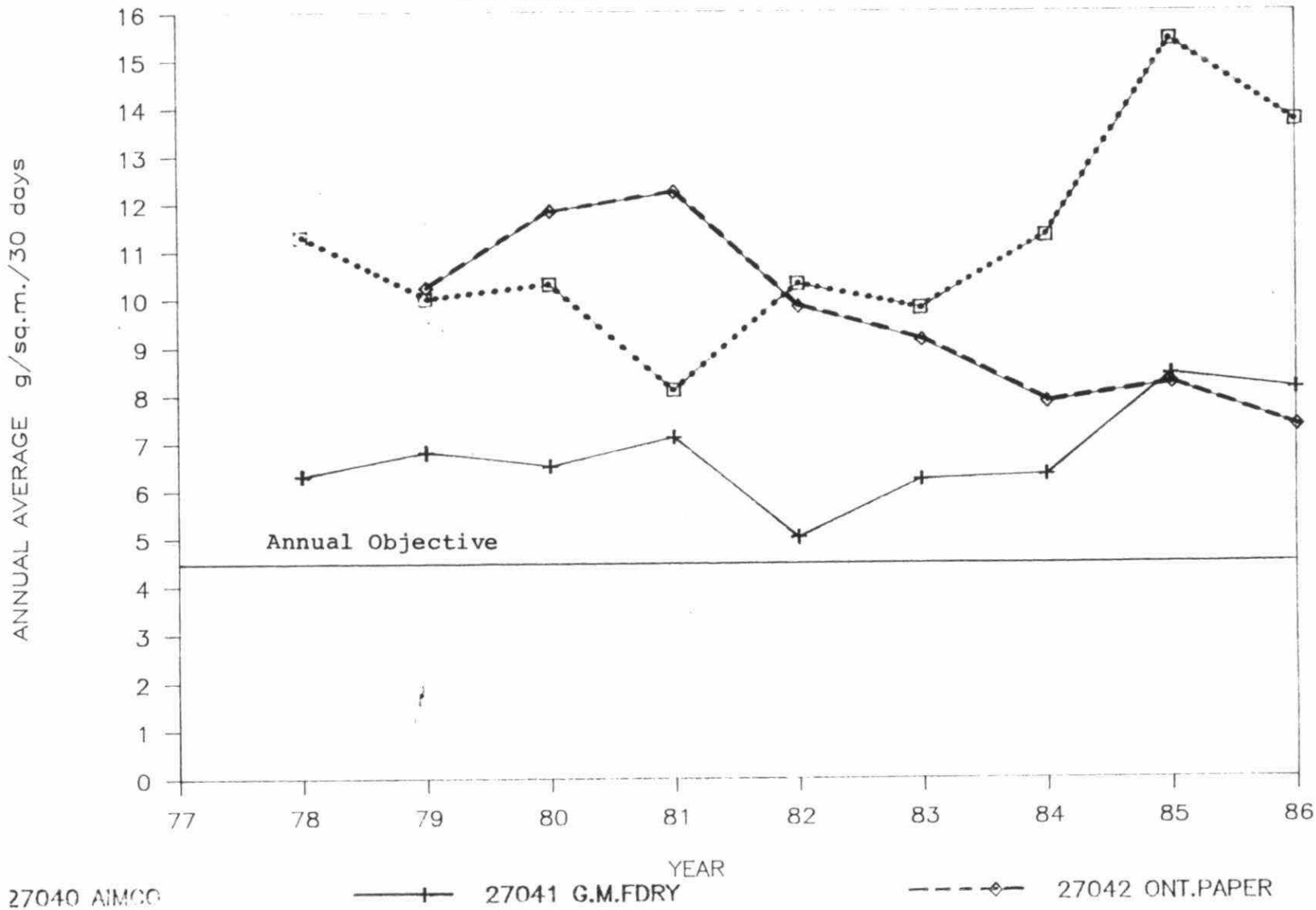


FIGURE 19

DUSTFALL YEARLY TREND

WELLAND & CHIPPAWA INDUSTRIES

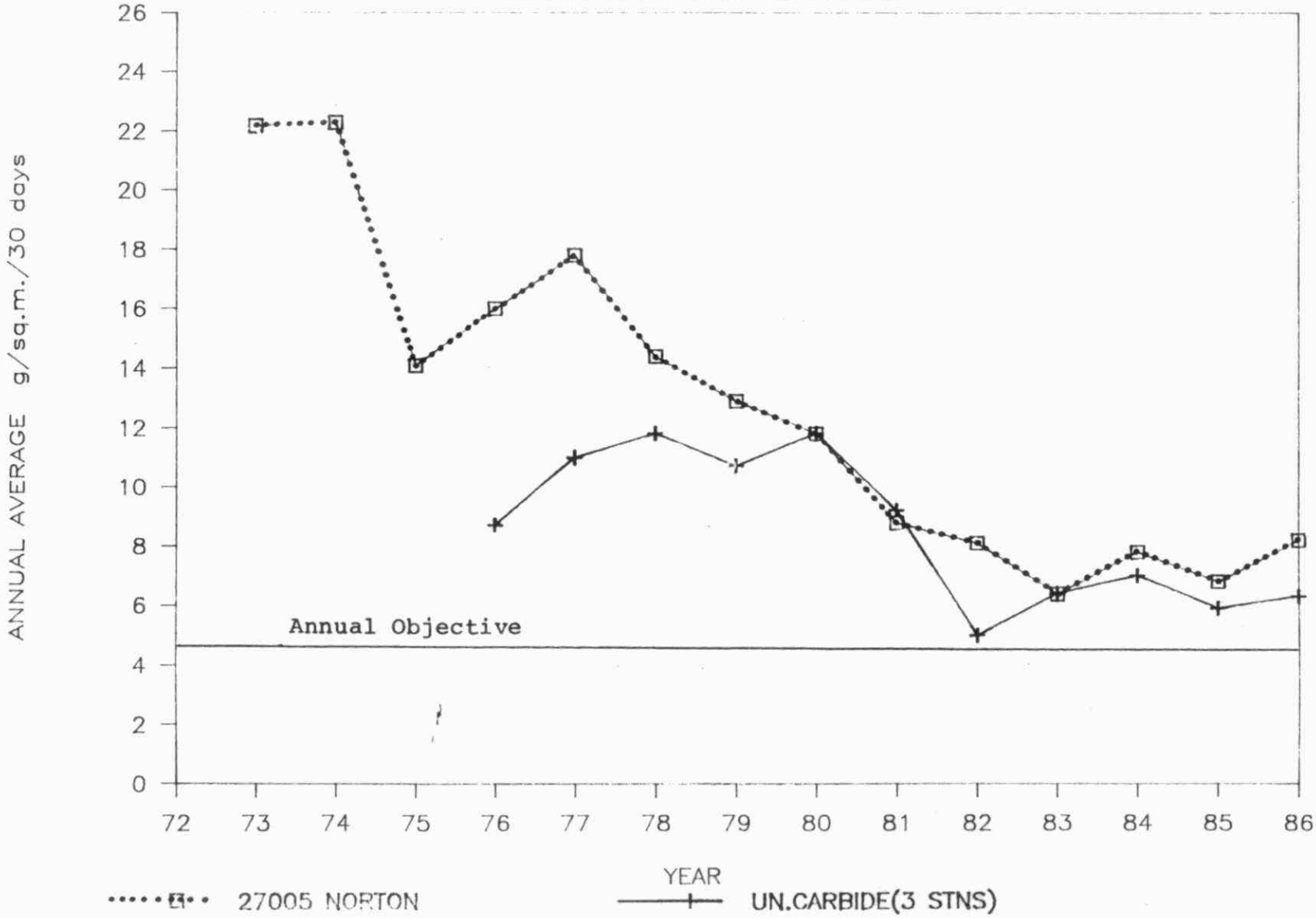


FIGURE 20
POLLUTION ROSE 1986
SULPHUR DIOXIDE
27056 ALLENDALE AVE., NIAGARA FALLS

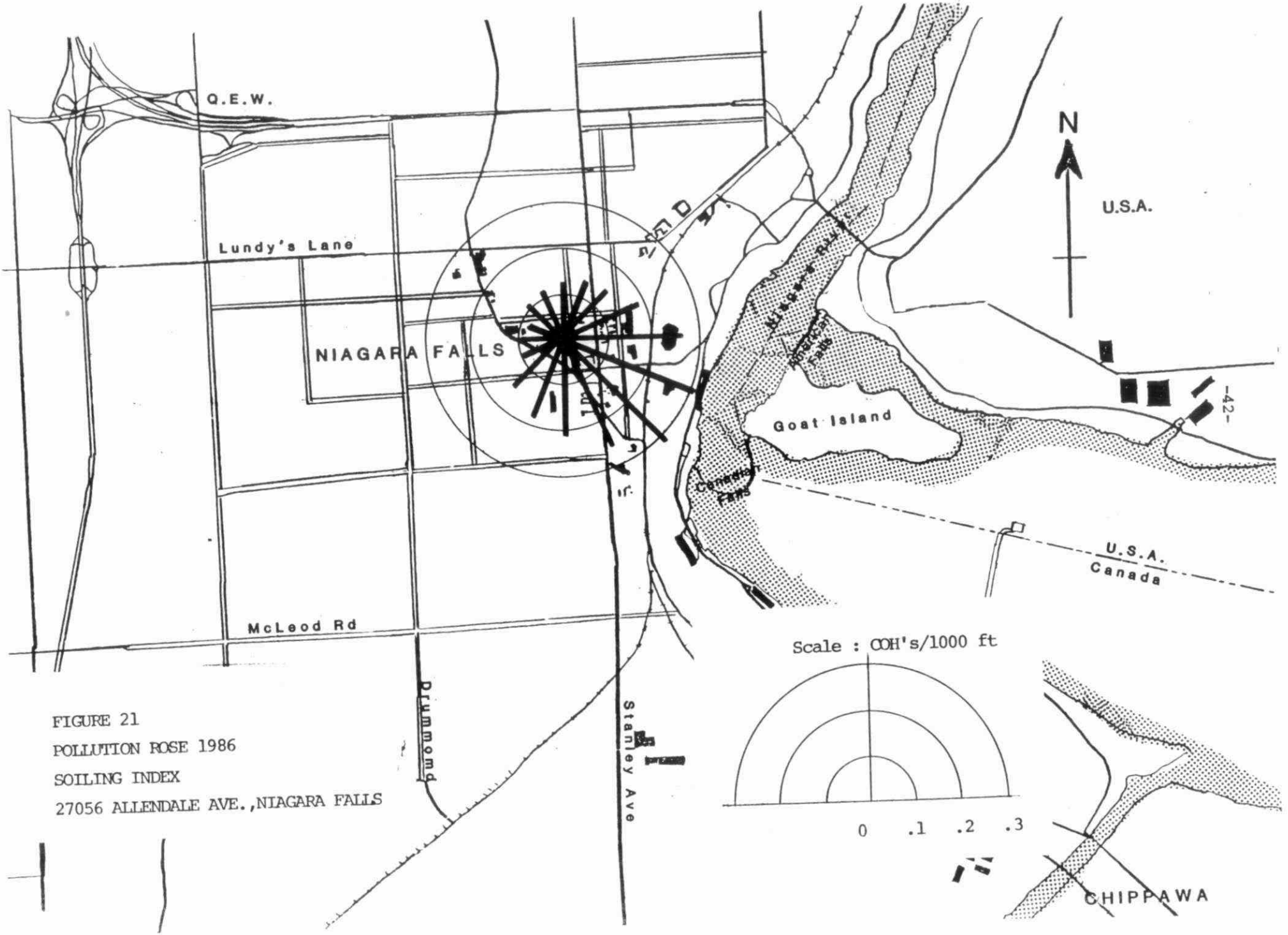


FIGURE 21
POLLUTION ROSE 1986
SOILING INDEX
27056 ALLENDALE AVE., NIAGARA FALLS

FIGURE 22
POLLUTION ROSE 1986
SULPHUR DIOXIDE
27055 STANLEY AVE., NIAGARA FALLS

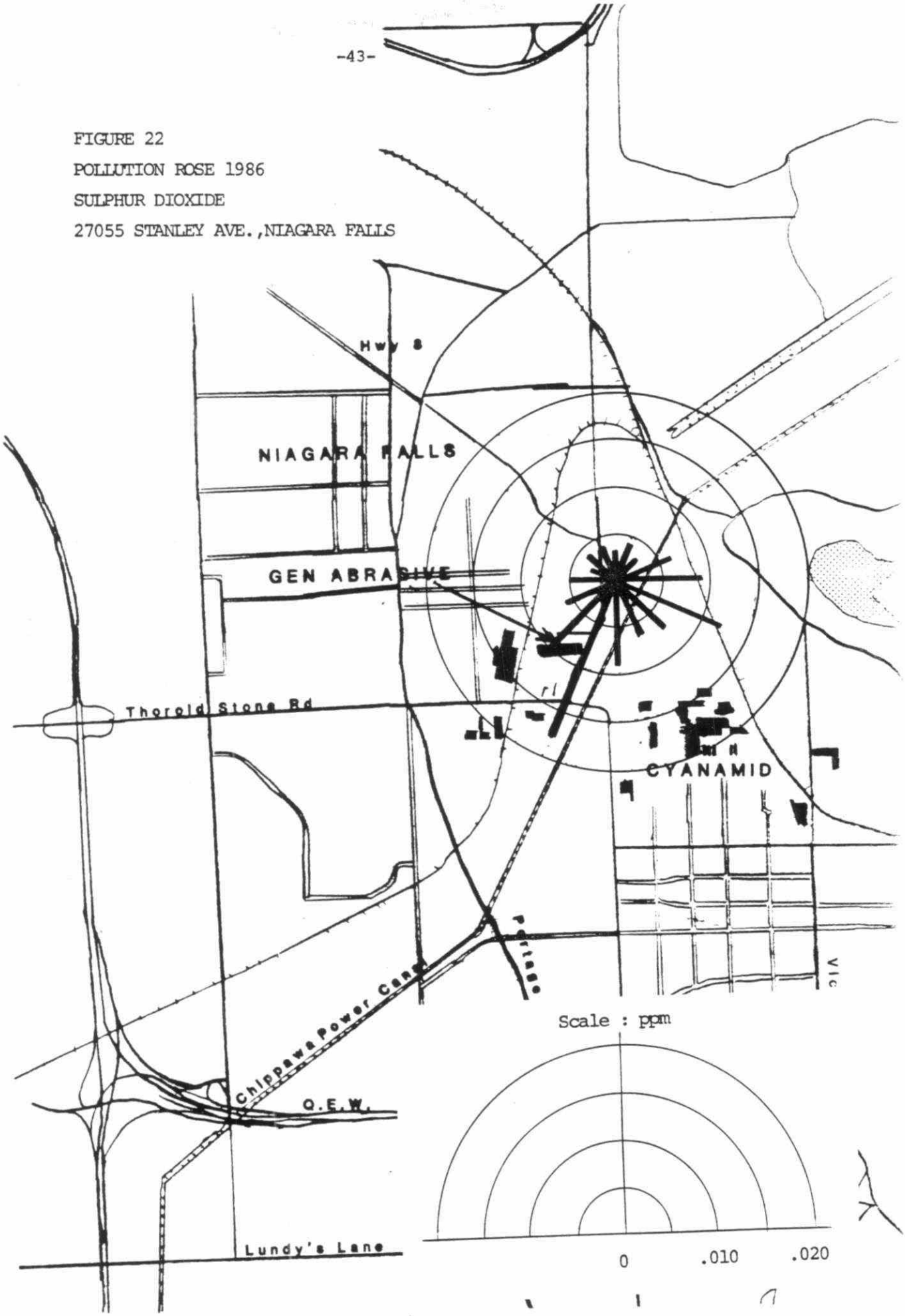


FIGURE 23
POLLUTION ROSE 1986
TOTAL REDUCED SULPHUR
27055 STANLEY AVE.,NIAGARA FALLS

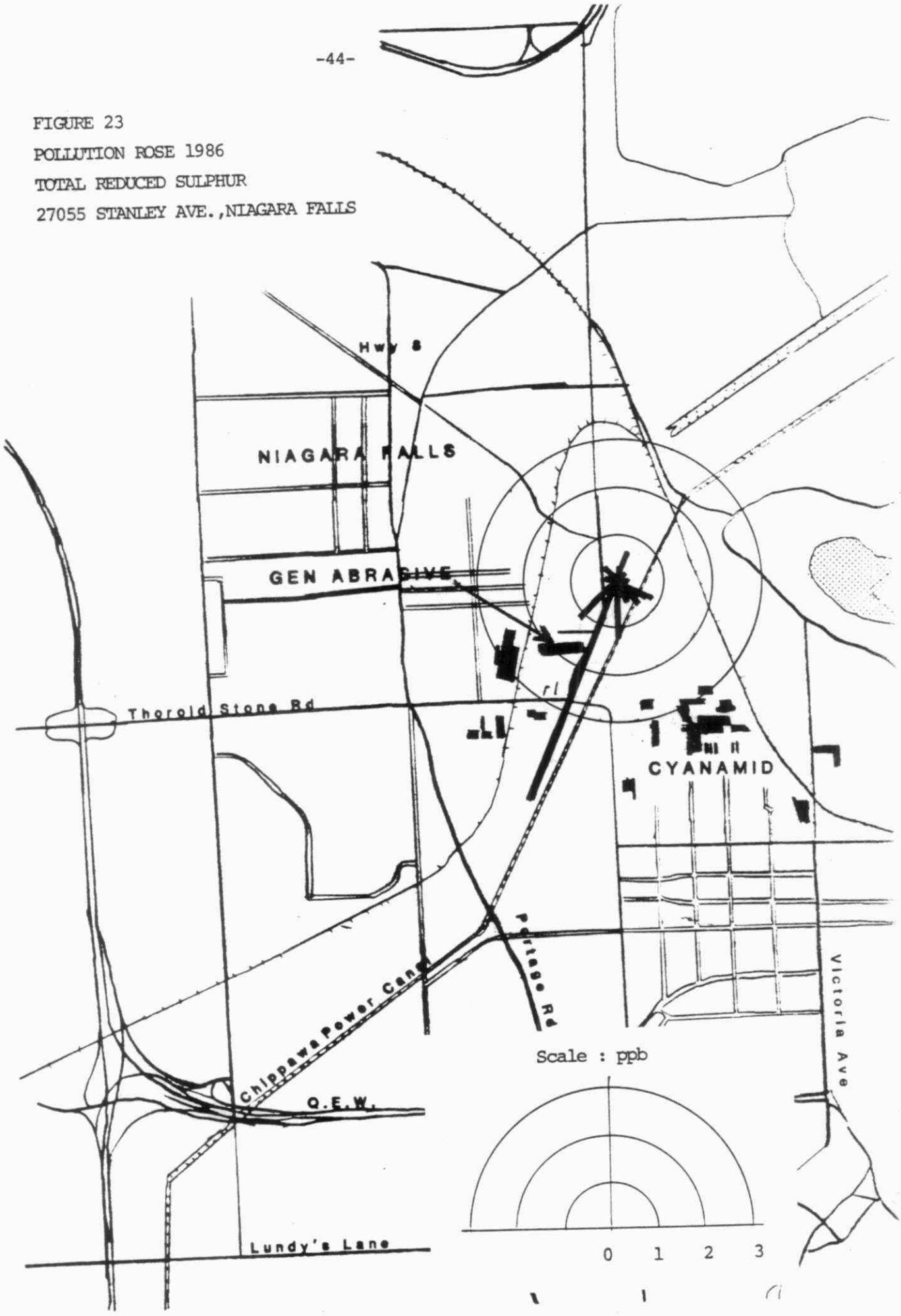
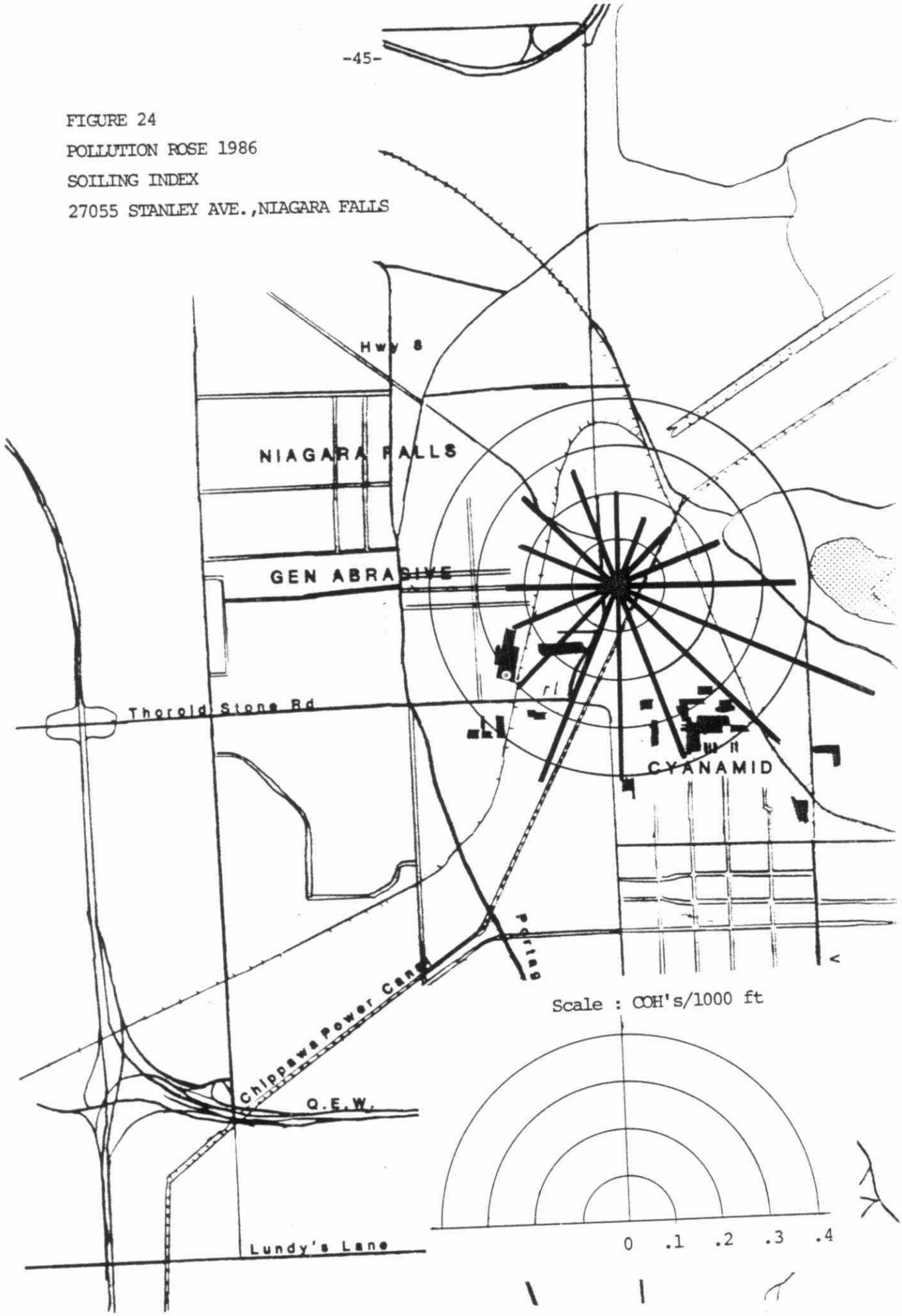


FIGURE 24
POLLUTION ROSE 1986
SOILING INDEX
27055 STANLEY AVE.,NIAGARA FALLS



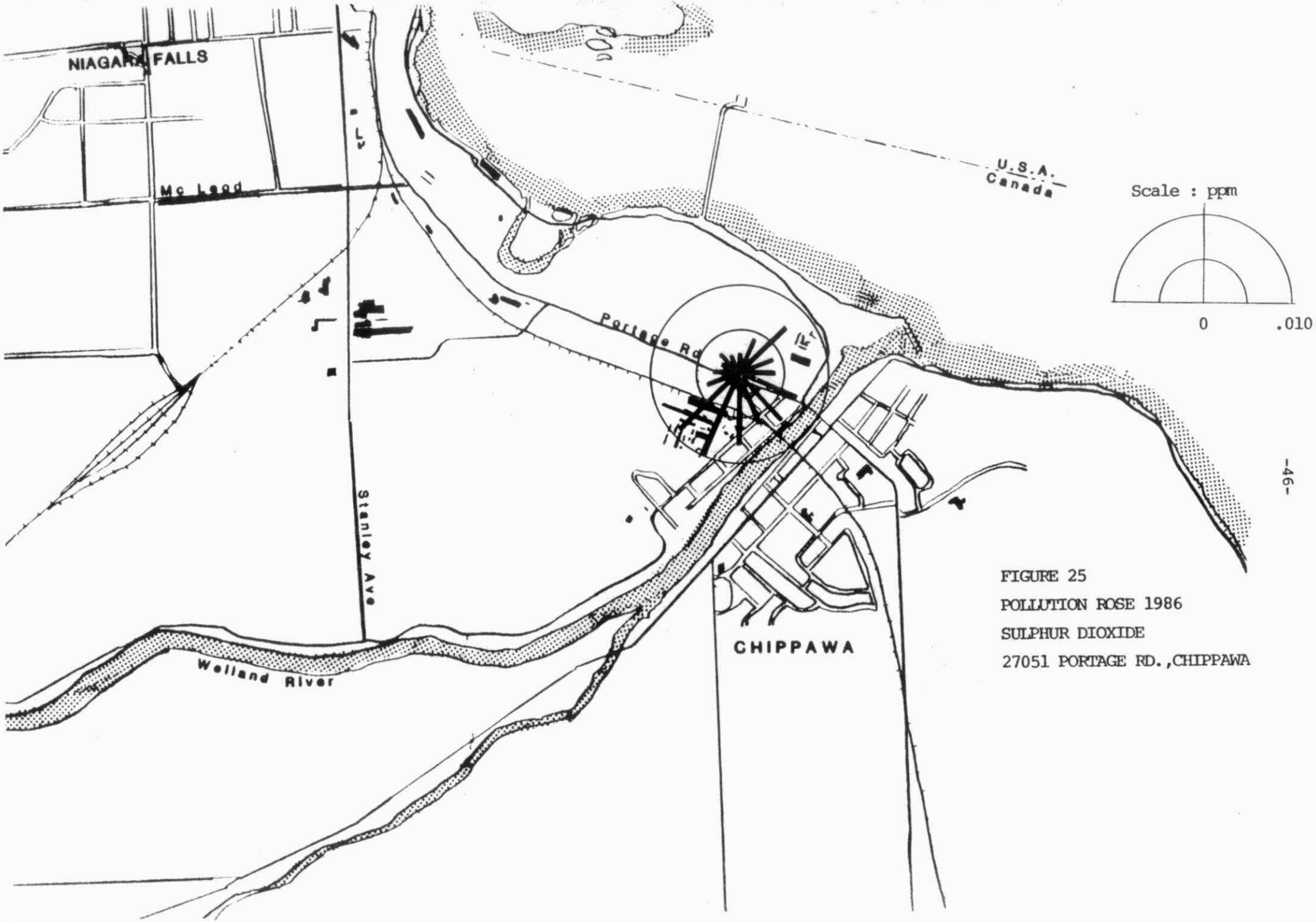


FIGURE 25
POLLUTION ROSE 1986
SULPHUR DIOXIDE
27051 PORTAGE RD., CHIPPAWA

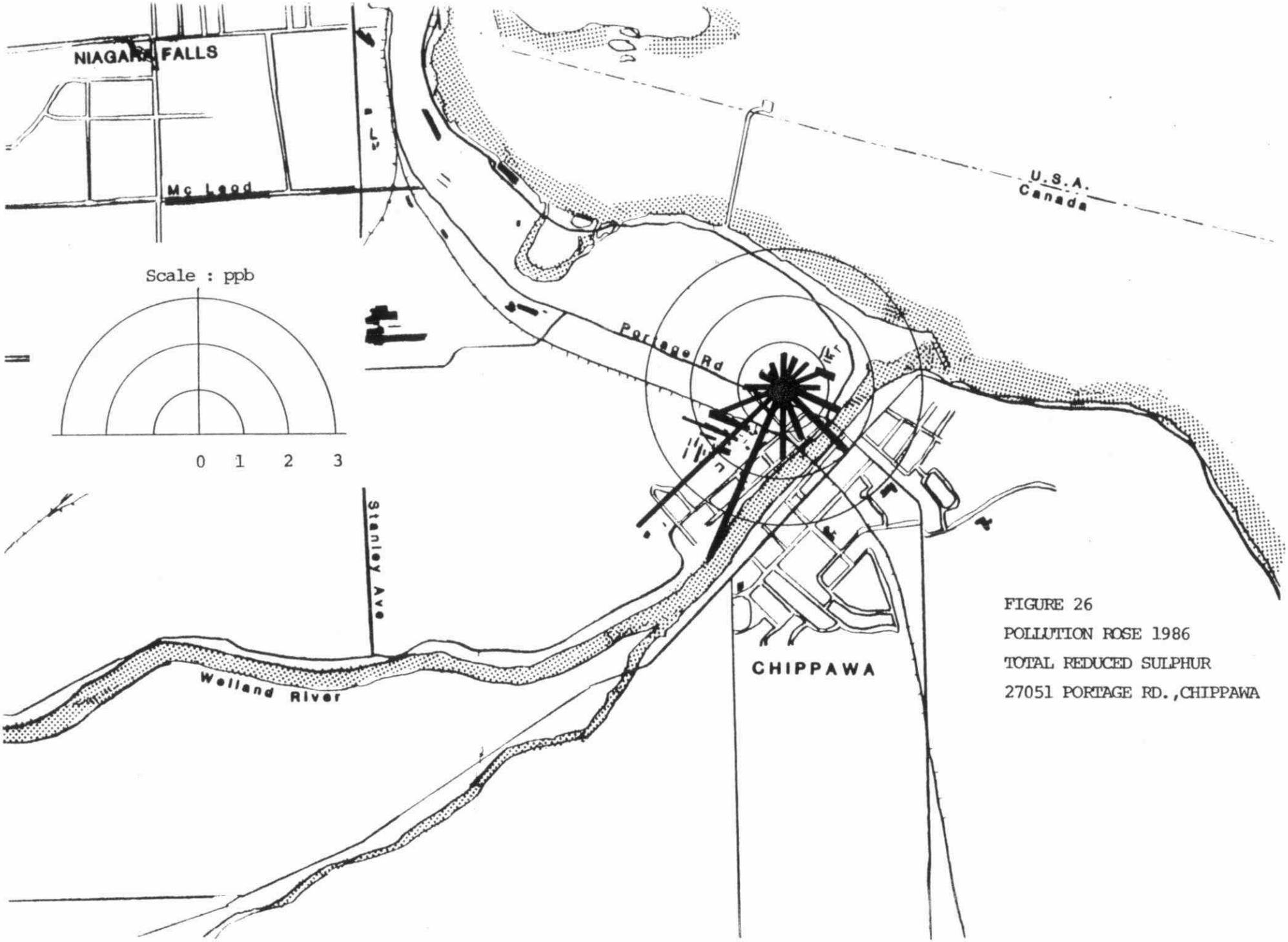


FIGURE 26
POLLUTION ROSE 1986
TOTAL REDUCED SULPHUR
27051 PORTAGE RD., CHIPPAWA

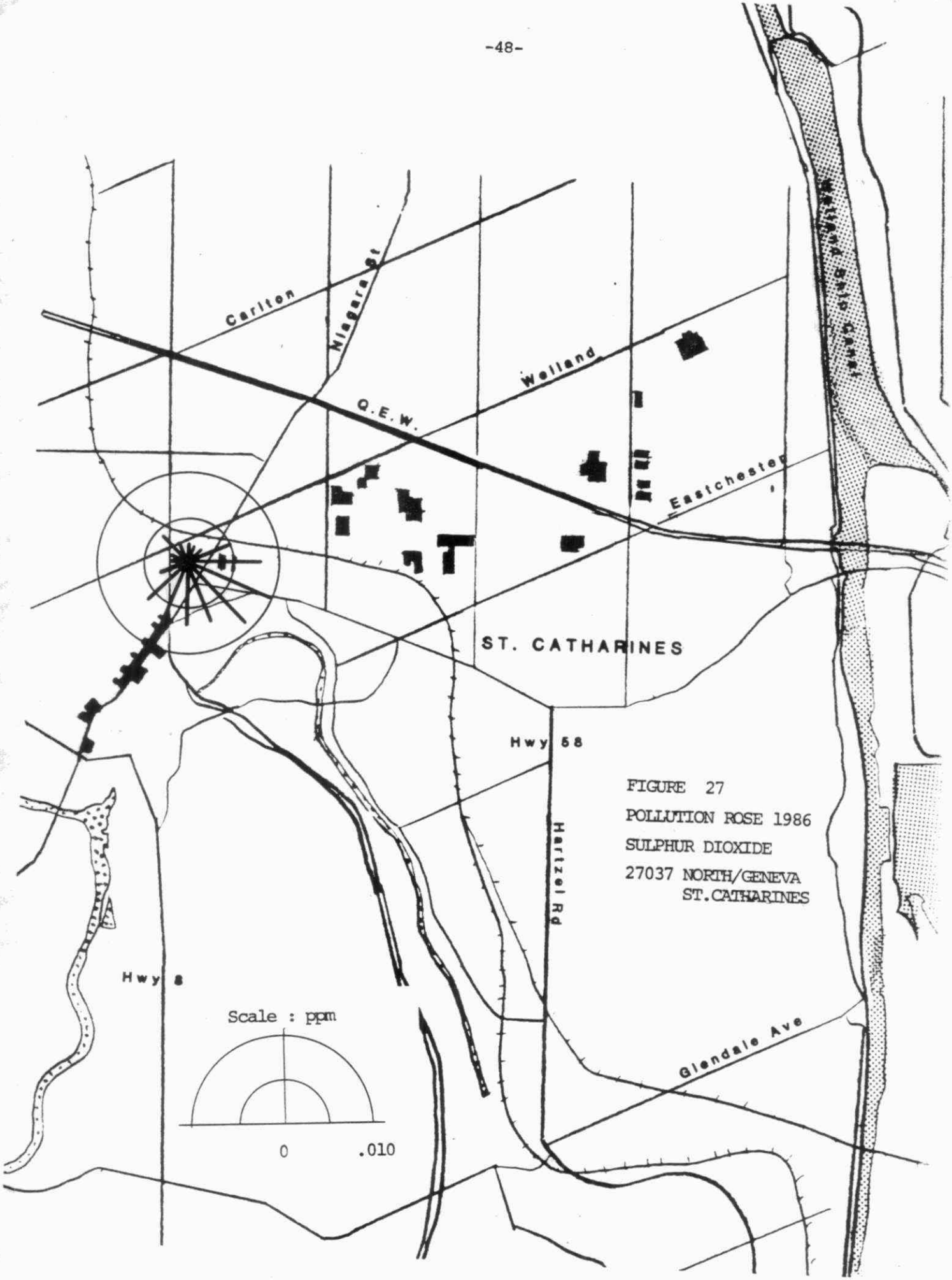


FIGURE 27

POLLUTION ROSE 1986

SULPHUR DIOXIDE

27037 NORTH/GENEVA
ST.CATHARINES

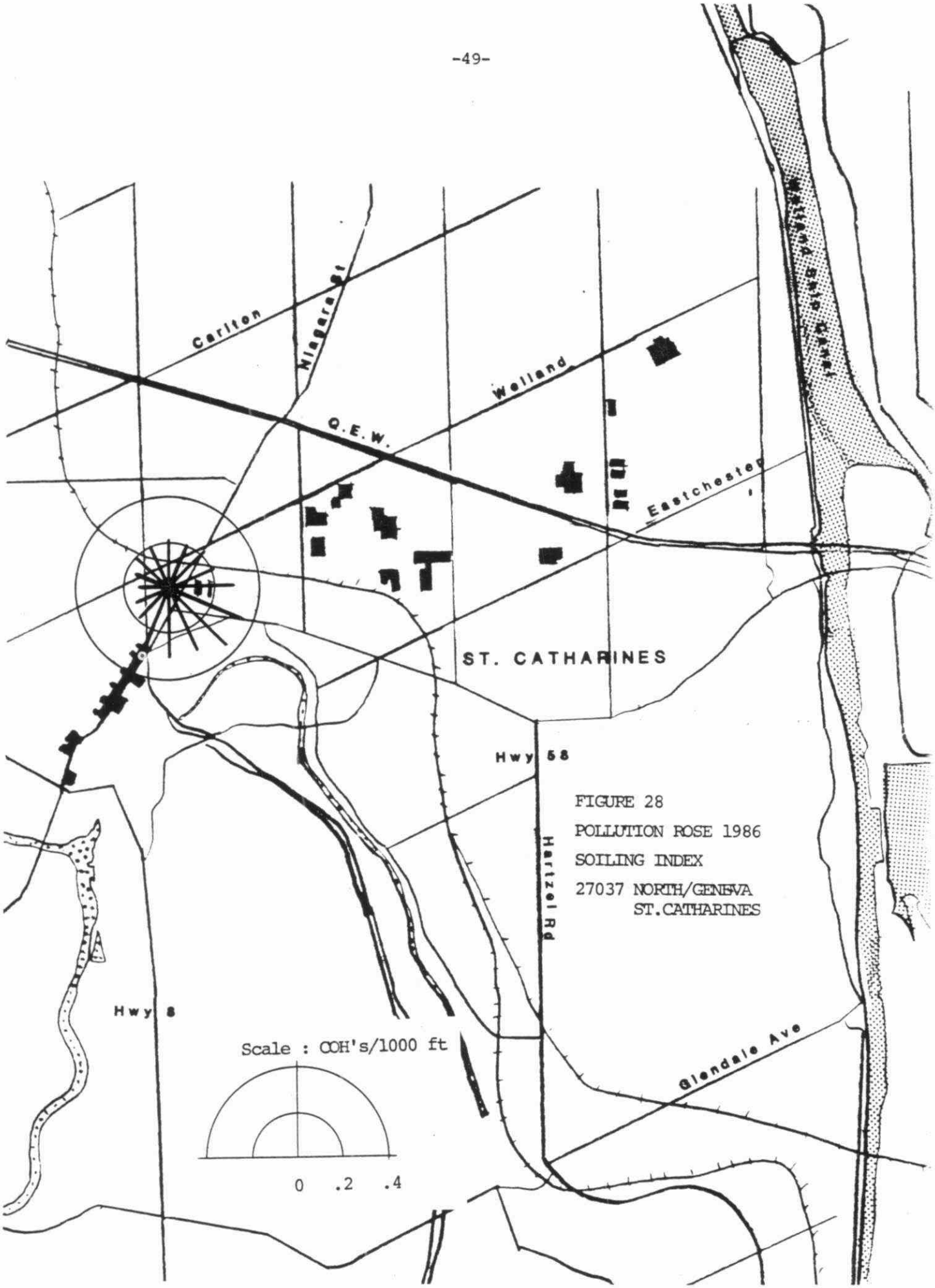


FIGURE 28

POLLUTION ROSE 1986

SOILING INDEX

27037 NORTH/GENEVA
ST.CATHARINES

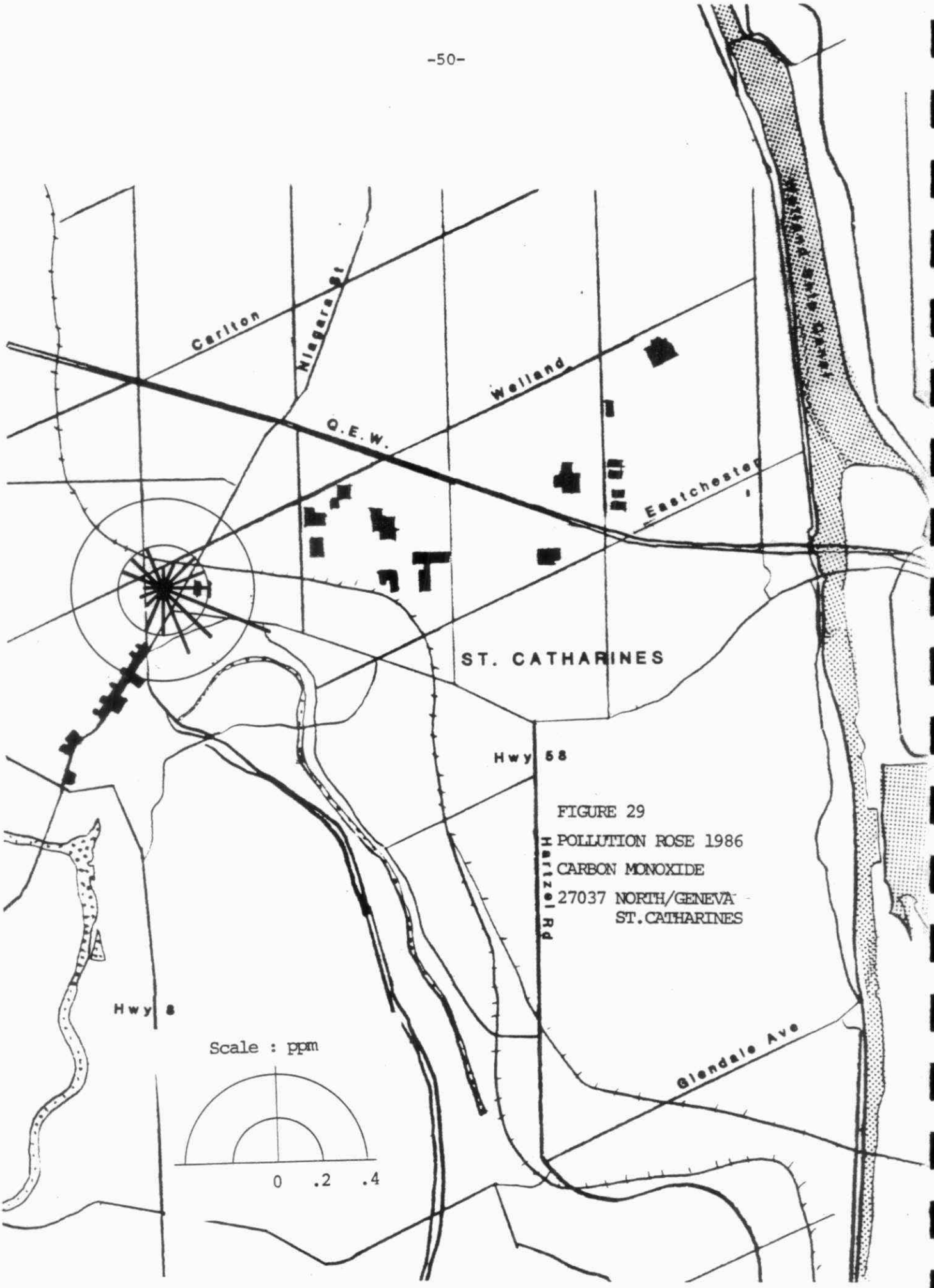


FIGURE 29

POLLUTION ROSE 1986

CARBON MONOXIDE

27037 NORTH/GENEVA
ST.CATHARINES

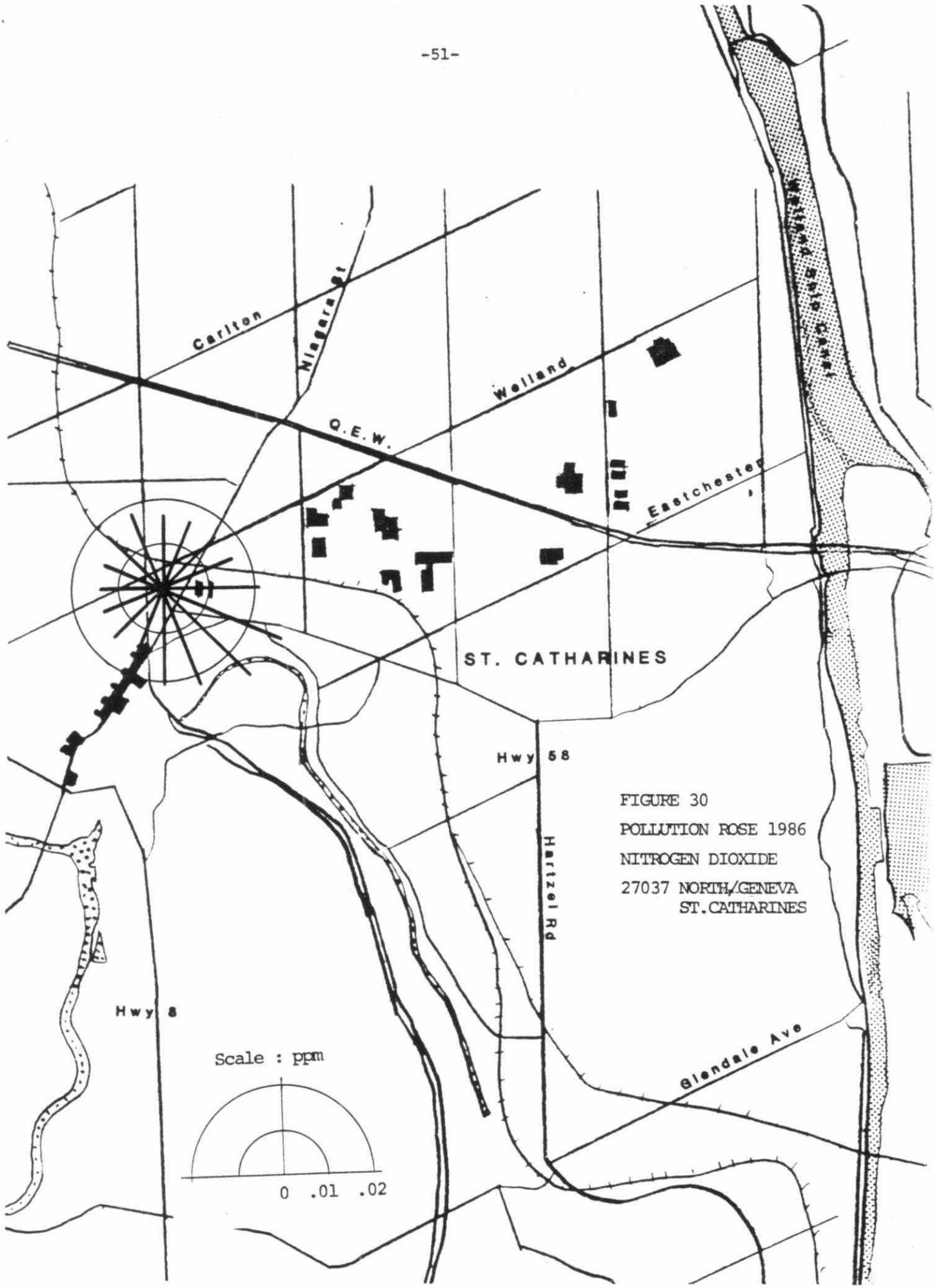


FIGURE 30
POLLUTION ROSE 1986
NITROGEN DIOXIDE
27037 NORTH/GENEVA
ST.CATHARINES

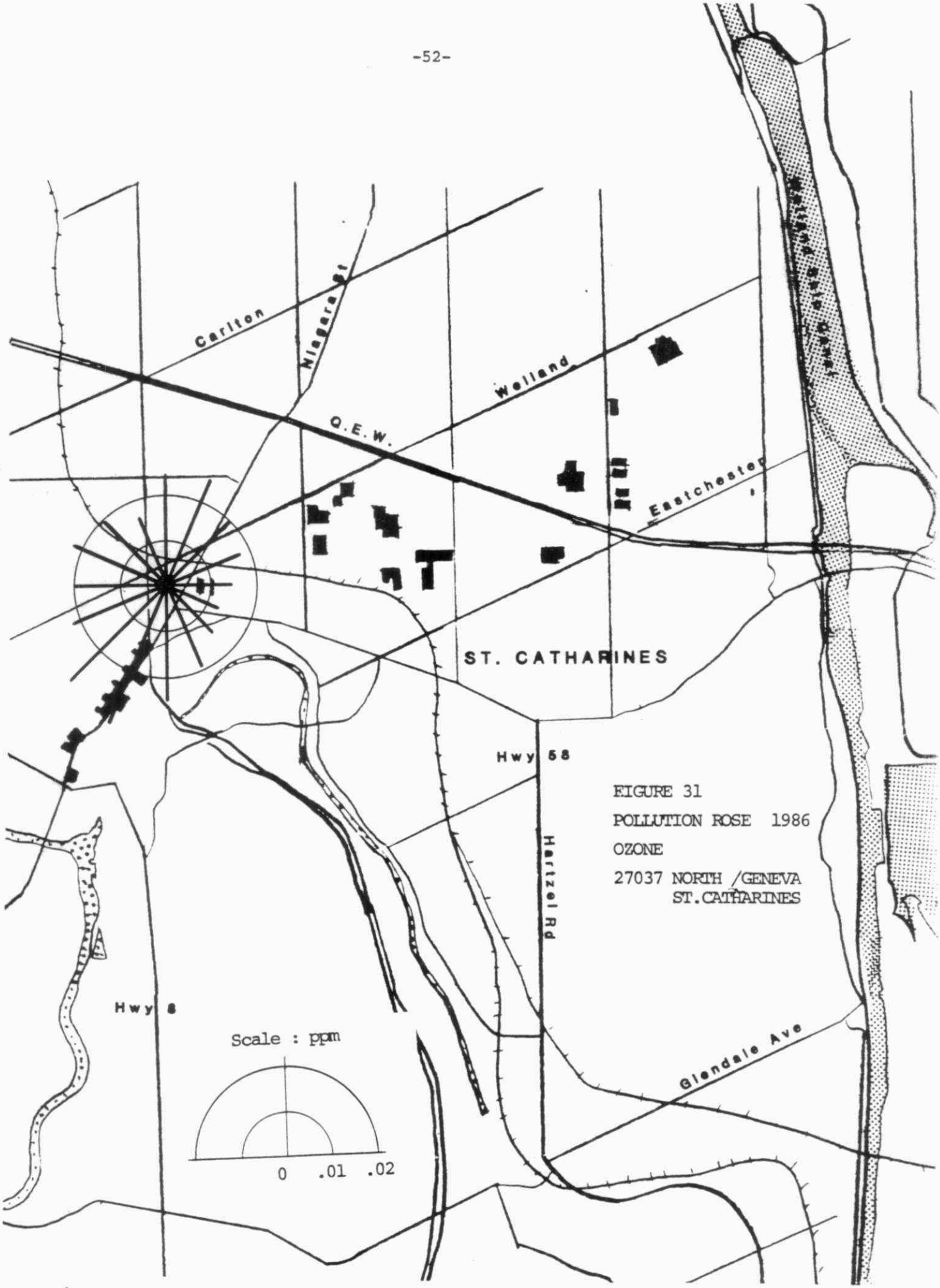


FIGURE 31

POLLUTION ROSE 1986

OZONE

27037 NORTH /GENEVA
ST.CATHARINES

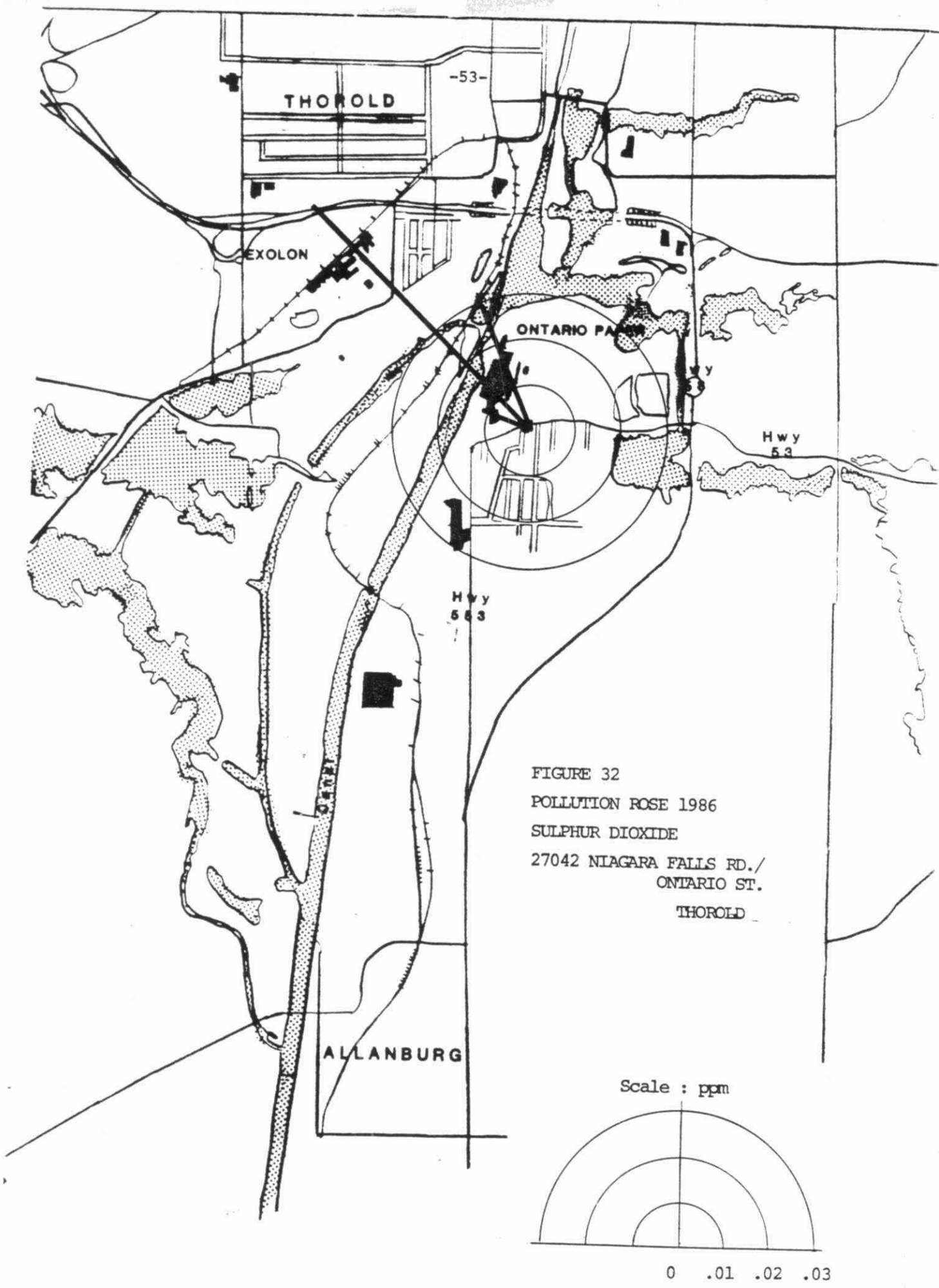


FIGURE 32

POLLUTION ROSE 1986

SULPHUR DIOXIDE

27042 NIAGARA FALLS RD./
ONTARIO ST.

THOROLD

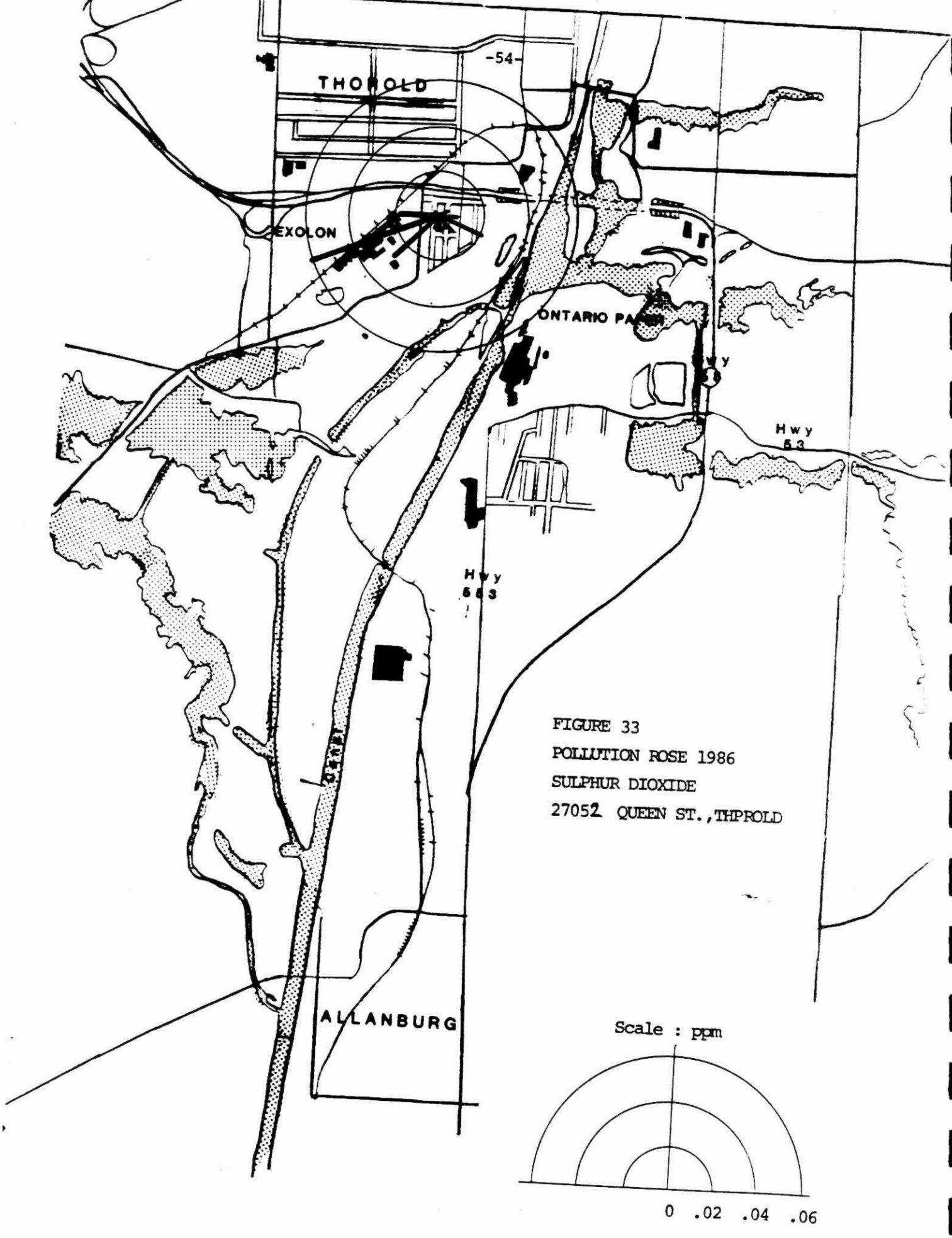


FIGURE 33
POLLUTION ROSE 1986
SULPHUR DIOXIDE
27052 QUEEN ST., THPROLD

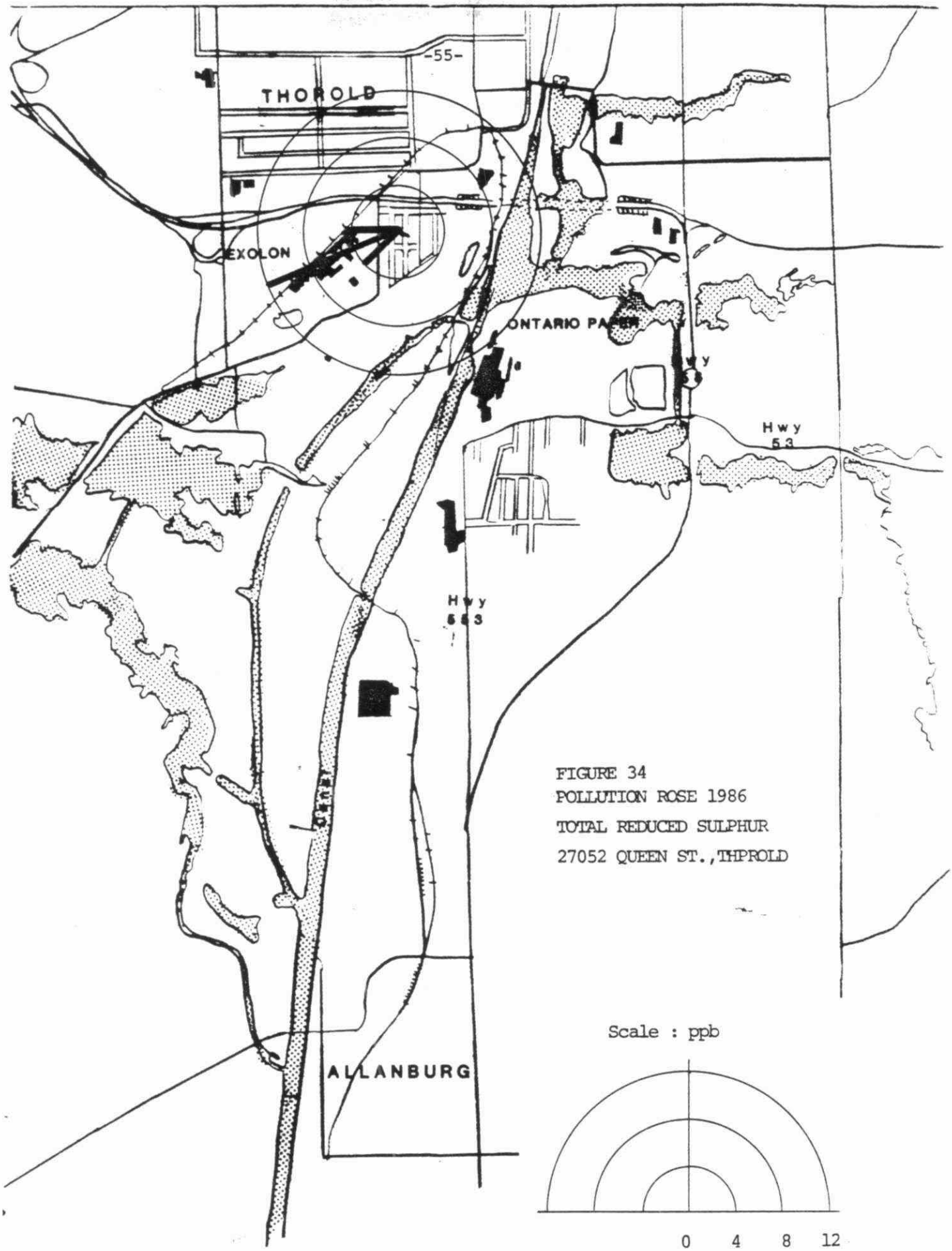


FIGURE 34
POLLUTION ROSE 1986
TOTAL REDUCED SULPHUR
27052 QUEEN ST., THPROLD

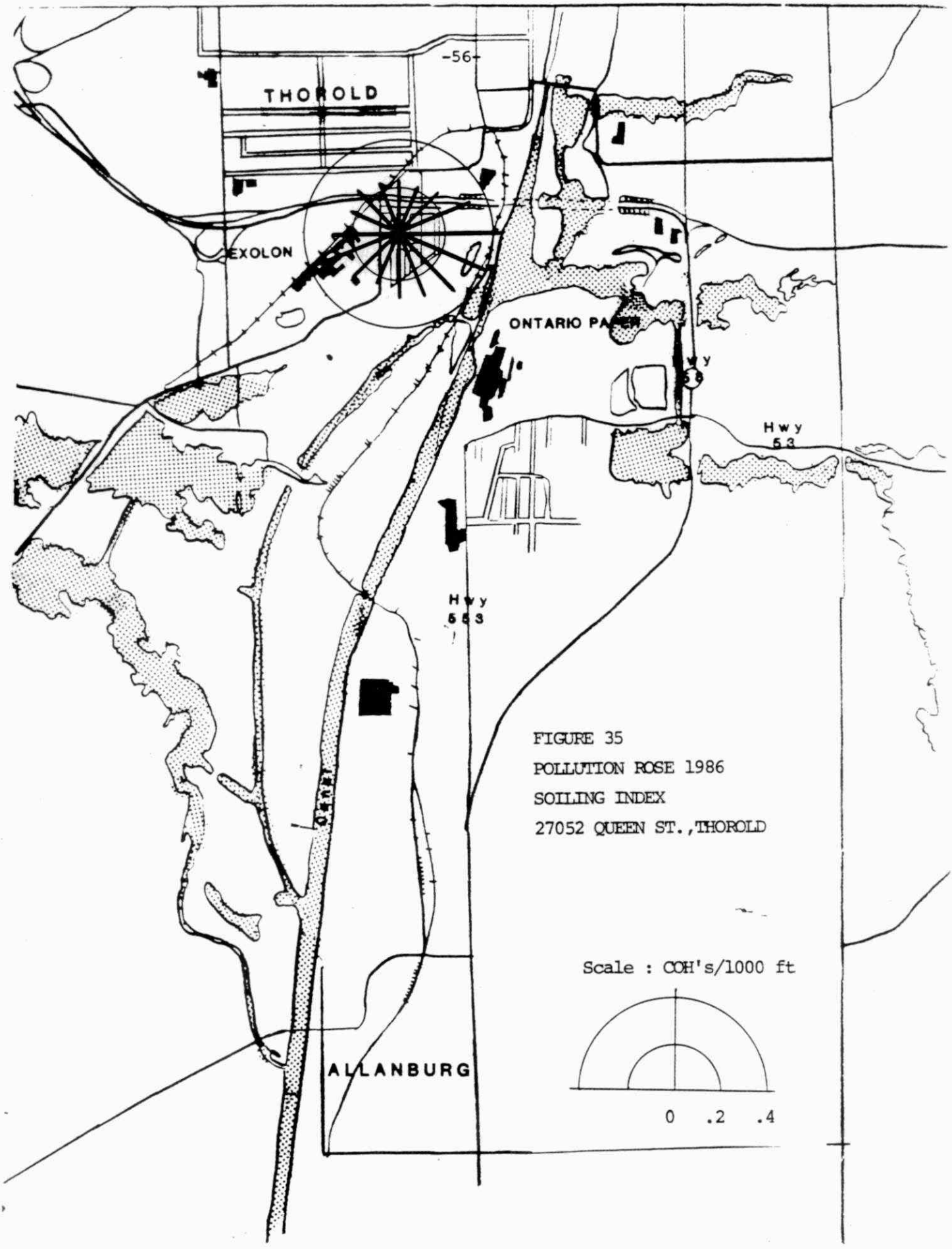


FIGURE 35
POLLUTION ROSE 1986
SOILING INDEX
27052 QUEEN ST., THOROLD

TABLE 1
SULPHUR DIOXIDE
UNIT - PARTS PER MILLION

Ontario Objectives: 1-Hour - .25
24-Hour - .10
1-Year - .02

LOCATION	ANNUAL AVERAGE 1984	1985	1986	1986 MAXIMUM 1-Hour	24-Hour	NO. OF TIMES ABOVE OBJECTIVE (1986) 1-Hour	24-Hour	SOURCE MONITORED
27056 Allendale Avenue Niagara Falls	.004	.003	.003	.06	.03	0	0	Ambient
27055 Stanley Street Niagara Falls	.006	.006	.008	.23	.07	0	0	General Abrasive Ltd.
27051 Norton/Portage Chippawa	.007	.005	.005	.10	.04	0	0	Norton Company
27037 North/Geneva St. Catharines	.005	.006	.005[9]	.13	.04	0	0	Ambient
27042 Niagara/Ontario Thorold	.001	.005	.005	1.29	.21	16	1	Ontario Paper Ltd.
27052 Queen Street Thorold	.011	.017	.012	.58	.32	16	2	Exolon

[9] - Numerical exponents refer to number of months sampled when less than 12

TABLE 2
TOTAL REDUCED SULPHUR
UNIT - PARTS PER BILLION

Ontario Objective: 1-Hour - 20 (Hydrogen Sulphide)

LOCATION	ANNUAL AVERAGE 1984	1985	1986	1986 MAXIMUM 1-Hour	NO. OF HOURS ABOVE OBJECTIVE 1984	1985	1986	SOURCE MONITORED
27051 Norton/Portage Chippawa	1.4[11]	2.1	2.2	47	78[11]	71	43	Norton Co.
27052 Queen Street Thorold	4.5	2.9	1.9	163	567	376	180	Exolon
27055 Stanley Street Niagara Falls	0.8	1.6	1.2	44	4	10	26	General Abrasive Ltd.

11 - Numerical exponent refers to number of months sampled when less than 12.

TABLE 3
SOILING INDEX (COEFFICIENT OF HAZE)
UNIT - COH'S PER 1000 LINEAR FEET OF AIR

Ontario Objectives: 24-Hour - 1.0
1-Year - 0.5

LOCATION	ANNUAL AVERAGE 1984	1985	1986	1986 MAXIMUM 24-Hour	NO. OF TIMES OVER 24-Hour OBJECTIVE 1984	1985	1986	SOURCE MONITORED
27056 Allendale Avenue Niagara Falls	.22	.20	.18	.9	0	0	0	Ambient
27037 North/Geneva St. Catharines	.24	.26	.24[9]	.8	1	2	0	Ambient
27055 Stanley Street Niagara Falls	.38	.33	.34	1.3	1	0	1	General Abrasive Ltd.
27052 Queen Street	.35[11]	.29	.30	1.0	1	0	0	Exolon

9 - Numerical exponent refers to number of months sampled when less than 12.

TABLE 4
OZONE
UNIT - PARTS PER BILLION

Ontario Objective: 1-Hour - 80

LOCATION	ANNUAL AVERAGE 1984	1985	1986	1986 MAXIMUM 1-Hour	NO. Of HOURS ABOVE OBJECTIVE 1984	1985	1986	SOURCE MONITORED
27037 North/Geneva St. Catharines	20.3	17.9	21.9[9]	91	19	19	11	Ambient/Long Range Transport

TABLE 5
CARBON MONOXIDE
UNIT - PARTS PER MILLION

Ontario Objectives: 1-Hour - 30
8-Hour - 13

LOCATION	ANNUAL AVERAGE 1984	1985	1986	1986 MAXIMUM 1-Hour	8-Hour	NO. Of TIMES OVER OBJECTIVE (1986) 1-Hour	8-Hour	SOURCE MONITORED
27037 North/Geneva St. Catharines	0.4	0.2	0.2[9]	8	3	0	0	Ambient

TABLE 6
NITROGEN DIOXIDE
UNIT - PARTS PER MILLION

Ontario Objectives: 1-Hour - .20
24-Hour - .10

LOCATION	ANNUAL AVERAGE 1984	1985	1986	1986 MAXIMUM 1-Hour	24-Hour	NO. Of TIMES ABOVE OBJECTIVE (1986) 1-Hour	24-Hour	SOURCE MONITORED
27037 North/Geneva St. Catharines	.018	.017	.019[9]	.11	.05	0	0	Ambient

[9] - Nine months sampled. Station terminated in September 1986.

TABLE 7
SUSPENDED PARTICULATES
UNIT - MICROGRAMS PER CUBIC METRE

Ontario Objective: 24-Hour - 120
1-Year Geo. Mean - 60

LOCATION	GEOMETRIC MEAN 1984	1985	1986	1986 MAXIMUM	% OF SAMPLES OVER 120 (1986)	SOURCE MONITORED
27056 Allendale Avenue Niagara Falls	48	44	42	111	0%	Ambient
27050 First/Bridge Niagara Falls	76	67	90*	205	16%	Cyanamid
27055 Stanley Street Niagara Falls	103	79	81	229	16%	General Abrasive Ltd.
27051 Norton/Portage Chippawa	73	64	62	214	5%	Norton Co.
27047 Davis/Fraser Port Colborne	57	49	52	150	3%	INCO
27037 North/Geneva St. Catharines	58	50	60[9]	227	9%	Ambient
27052 Queen Street Thorold	131	106	144	731	59%	Exolon
27045 Alberta/Devon Welland	58	48	42	117	0%	Union Carbide

* - Moved to 27050 from 27053 in early 1986.
9 - Nine months sampled. Station terminated in September 1986.

TABLE 8
CONSTITUENTS IN SUSPENDED PARTICULATES
UNIT - MICROGRAMS PER CUBIC METRE

NICKEL - Ontario Objectives: 24-Hour - 2.0

LOCATION	GEOMETRIC MEAN 1984	1985	1986	1986 MAXIMUM	% OF SAMPLES OVER 2.0 1984	1985	1986	SOURCE MONITORED
27047 Davis/Fraser Port Colborne	.071	.027	.017	2.2	2%	0%	2%	INCO

ELEMENTAL CARBON - Ontario Objective: None

27045 Alberta/Devon Welland	4.7	3.3	3.1	19.6				Union Carbide

TOTAL CARBON - Ontario Objective: None

27045 Alberta/Devon Welland	10.4	8.8	7.5	24.2				Union Carbide

TABLE 9
DUSTFALL
UNIT - GRAMS/SQUARE METRE/30 DAYS

Ontario Objectives: 1-Month - 7.0
1-Year - 4.5

LOCATION	ANNUAL AVERAGE 1984	1985	1986	1986 MAXIMUM 1-Month	NO. Of MONTHS ABOVE OBJECTIVE 1984	1985	1986	SOURCE MONITORED
27005 Portage/Legion Chippawa	7.8[11]	6.7[11]	8.2[11]	21.0	5	5	5	Norton Co.
27006 Bridgewater/Oliver Chippawa	3.5	2.8	3.3	12.1	1	0	1	Norton Co. Background
27040 Plymouth Avenue St. Catharines	11.3	14.5	13.7	28.9	8	11	9	Aimco Foundry
27041 Glendale/QEW St. Catharines	6.3	8.2	8.1	13.2	2	9	7	G. M. Foundry
27054 Catherine/Russel St. Catharines	8.0	6.4	8.8	31.4	4	4	4	Burnstein Foundry
27042 Niagara/Ontario Thorold	7.8	7.7	7.3	10.4	5	7	7	Ontario Paper
27043 McAdam Park Thorold	4.2[9]	3.9	3.2[11]	5.3	2	1	0	Ontario Paper Background
27025 Harriet Street Welland	4.9	4.8	4.6	10.5	1	1	2	Union Carbide
27026 Chaffey Street Welland	6.0	4.9	4.4	8.6	2	2	2	Union Carbide
27035 Alberta Street Welland	10.2	7.4	9.9	20.3	8	5	9	Union Carbide

[11] - Exponents refer to number of valid monthly samples when less than 12.